MODERN PLASTICS

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VOLUME 16 NUMBER 11

• GENERAL INTEREST

• TECHNICAL SECTION

• NEWS AND FEATURES

Cover Color this Month FRENCH SLATE (Created by Textile Color Card Association)

AUGUST

For more than two years, prominent artists, designers, architects and craftsmen have been laboring with plastics to turn out incredulous exhibits, displays, fantasmagoria, for the New York World's Fair. For more than two months we have been trying to run them down and get photographs of some of the more interesting results of this creative approach to comparatively new materials in art and architecture. In the August issue, you shall see how we made out.

You may also see, in that issue, how toy and game manufacturers are improving their product, increasing sales, saving shipping costs and breakage, giving the youth of America more safe and sane playthings through the use of plastic materials.

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MODERN PLASTICS

JULY 1939 VOLUME 16 NUMBER 11

SUPERFINISH FOR MOLDS?

by R. T. STEWART*

This superior finish developed for automotive metal parts may contribute to more perfect surfaces on plastic molds

PROBABLY NO GROUP OF PEOPLE IN INDUSTRY is more "finish" minded than those working in plastics. It is a subject that is heard from morning to night, day in and day out, the year round. The plastic buyer, the plastic salesman, the molder, the mold maker and even the supplier of steel and materials for molds are aware of the vital importance of finish in the plastic industry.

Of course, it is realized that plastics have a manifold number of appeals which make them so popular in all phases of everyday life. In our automobiles, in our homes and everywhere we go we meet with plastics in one form or another. Some uses stress pure beauty of color and shapes, others the utility and still others its economy, lightweight, permanence, etc. All of these appeals have a common denominator in surface finish.

The buyer is interested primarily in the surface finish of his particular product, because it enhances its beauty and stimulates sales. He realizes that there is a relation between beauty as visualized by the eye and the finish as we feel it. This relationship is best expressed by the almost irresistible impulse of the average person upon viewing a beautiful vase, table top or even an automobile to touch it and see how it feels. Frequently this feel (or finish) establishes a reaction in the mind which increases or decreases the person's idea of the beauty of the object.

The plastic salesman usually is very careful to explain to a prospective buyer that his product has an excellent surface. He may amplify this by telling how careful they are to produce this surface on each and every part, and the special manufacturing precautions they take to insure this.

The molder is really the one most interested in surface finish because he has two surfaces to be concerned with: (a) Surface of product; (b) Surface of molds.

It is well known in the molding of plastics that the surface of the mold is directly reflected on the surface of the part when made. The defects in molds are exactly reproduced in the casting. Surface scratches even as minute as one millionth of an inch in depth on a mold can be found on the casting. It is a matter of simple manufacturing economics for the molder to eliminate as many defects in the mold as possible because he knows these scratches must be removed eventually from the molded part at an extra expense. It is the removal of these small surface defects that is troublesome to the mold maker. It is one of the reasons for the high cost of plastic molds because it is usually a hand operation.

Surface finish in plastics is a requirement for appeal to eye and sense of touch, but surface finish has recently been recognized in another field in its ultimate effect which has no relation to looks. In fact it has been proven that the eye is very deceiving as to quality of smoothness on a metallic surface. A high reflective surface may not be as smooth as one that is dull.

All this leads as to the reasons why a new development in the automotive field may soon be of importance to the plastic industry. This new development was made for an entirely different purpose than finishing of plastic molds, but in the final analysis surface finish was the ultimate goal.

Fig. 1. Photomicrograph of a front wheel bearing, finished by conventional methods, showing "brinelling" or slight indentations on the surface. Cars equipped with these, it has been discovered, soon develop objectionable wheel bearing noises

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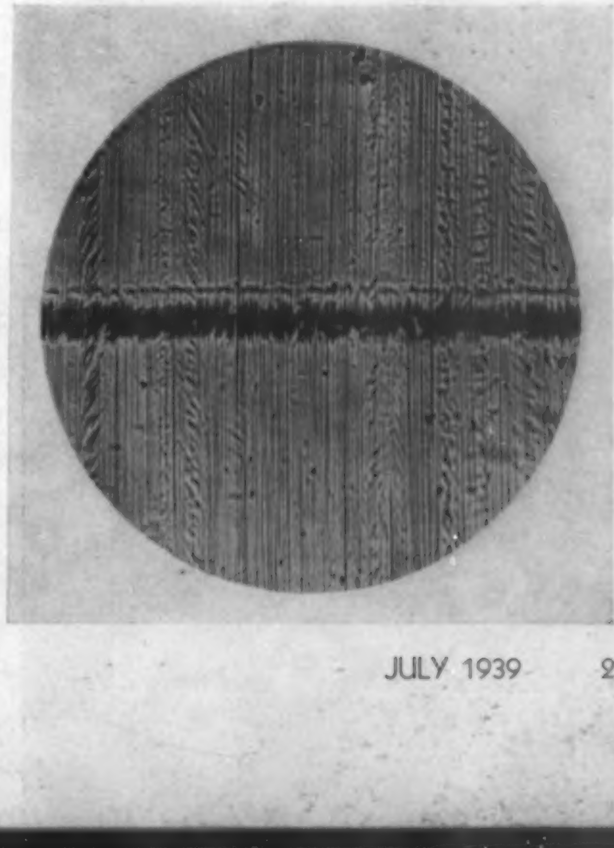
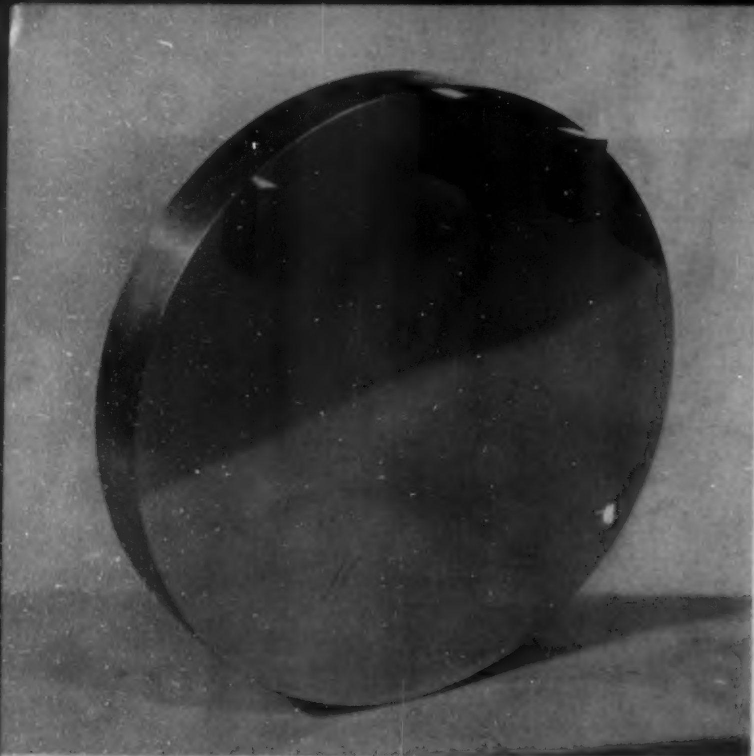


* Production Research Dept. Chrysler Corp.



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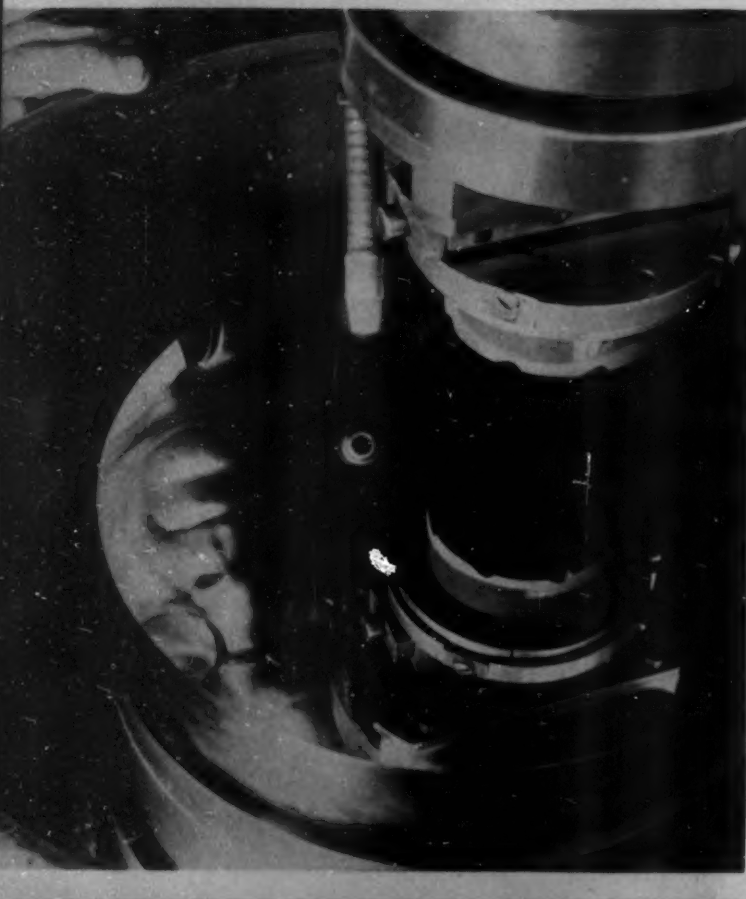

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The development of Superfinish by the Production Research Dept., of the Chrysler Corp., under the direction of David A. Wallace, president of Chrysler Division, could be written as a romance in industry. The word romance could be used in the strict dictionary meaning, or as a means of identifying the fact that Mr. Wallace and his boss, K. T. Keller, president of the Crysler Corp. were convinced that surface finish could and must be improved in order to obtain: increased life for frictional and so-called anti-friction moving parts, quiet operation, and elimination of long "run-in" period for automobiles.

Like all research problems the present state of perfection in superfinish was not brought about over night. In fact experimental work has been going on in the laboratory and in production of parts since 1934 when the need for a new finish was first shown as an imperative necessity. Strangely this need was first recognized on parts that had a very high reflective surface and appeared to be the last word in smoothness.

It is not within the scope of this paper to relate the history of this development, but it is interesting to note that it started with the fact that cars shipped over long distances by rail later developed an objectionable wheel bearing noise. This was traced down and found to be caused by a so-called "brinnelling" (slight indentation) (Fig. 1) of the smooth races of anti-friction bearings. The elimination of this effect was the starting point for Mr. Wallace in the program of developing superfinish which he describes as follows:

"Superfinish is the name of a recently developed, mechanically-made finish that is superimposed on machined metal surfaces, changing the metallurgical and physical conditions of the metallic surface by the removal of non-

Fig. 2. This 10 in. steel disk, with three gage blocks "wrung" onto the surface, was superfinished in a flat machine (Fig. 3.) from a ground surface, in 30 seconds. The mirror-like surface obtained is indicated by the clear reflection of the operator's face in the disk. Fig. 4 illustrates the effect on metal of the superfinishing process. Fig. 5. Photomicrograph of an actual cross section of ground metal, clearly defining the irregular contour and disturbed metal on the surface. This same metal, superfinished, (Fig. 6) is smooth and even and any remaining scratches are below the surface

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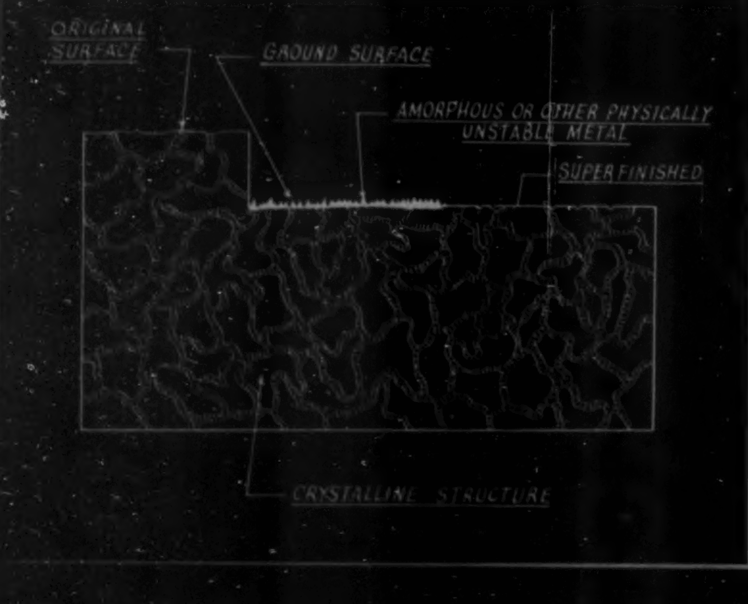

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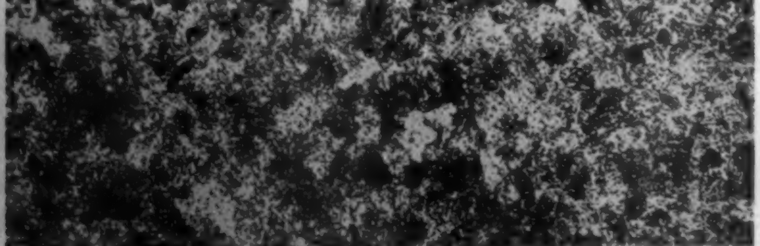

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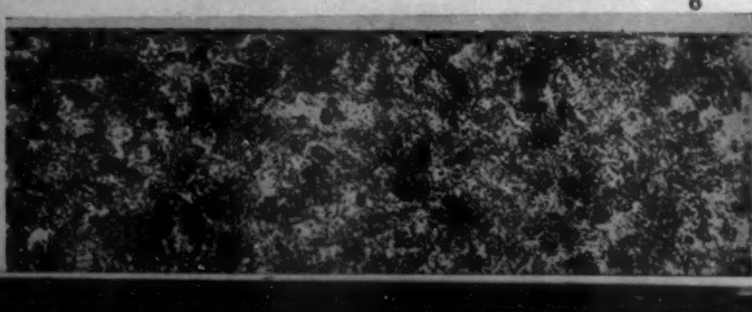

crystalline, fragmented, de-carbonized, amorphous or smear metal that has been created by the dimensional operations of turning, grinding, burnishing, honing and other machining methods. The superfinishing operation removes defective metal, thus exposing for bearing contact the undisturbed crystalline metal, simultaneously producing a smooth, geometrically developed surface.

"Surfaces thus finished are produced by special machines using bonded abrasives, slow abrasive speeds, low abrasive pressures, multi-motion and proper lubricant. Superfinishing is a mechanical operation which removes the defective metal from the bearing surface so that any minute defects that remain are below the bearing contact surface that supports the oil film and maintains indefinitely the initial clearance built into the bearing between contacting surfaces and requires no "break-in" period where there is proper design, alignment and lubrication. This finish can be produced upon flat, round, concave, convex and other surfaces, either external or internal."

The definition, as given by Mr. Wallace, carries most of the salient features but does not give the time element involved. Of course this depends somewhat on the part and the degree of smoothness required. To appreciate the speed with which the finish is performed you really need to see the machines in operation. You men who are used to seeing a die maker polish by hand for hours on a small piece will be surprised to learn that by the special process, it is possible to produce an ultra-smooth surface on a 10 in. disk in minutes instead of hours. (Figs. 2-3). This disk, when superfinished, will be of high reflecting character (mirror) and will have a surface defect of less than 2 micro-inches (.000002 in.). In the finishing of Chrysler Corp. parts none require more than 45 seconds stone contact time.

It has been stated that ordinary machining methods produce certain unstable physical conditions on the surface of the metal described as, de-carbonized, amorphous, smear metal, etc. Figs. 4, 5 and 6 illustrate the removal of this material by the finishing operation. One or more of these physically unstable metal conditions may exist on the surface of a machined part. Their removal is imperative for a truly smooth surface.

Figs. 7, 8 and 9 illustrate the manner in which multi-motions are applied to various parts of the automobile during the superfinishing operation.

The diagram in Fig. 11 illustrates why a superfinished surface is different from a surface produced by any other mechanical method. It further illustrates that any defects in a surface thus finished are below the base line. This is the result of low abrasive pressures, low abrasive speeds and proper viscosity of coolant (lubricant) while the scrubbing action of the abrasive stones is taking place in the process. This combination of conditions can best be described by stating that just enough pressure is applied to the stones so that the myriad of high spots on the surface will puncture the coolant film and will be scrubbed by the stones.

This action continues until finally a point is reached where the surface is smooth enough so that the lubricant film is no longer punctured and (*Please turn to page 80*)

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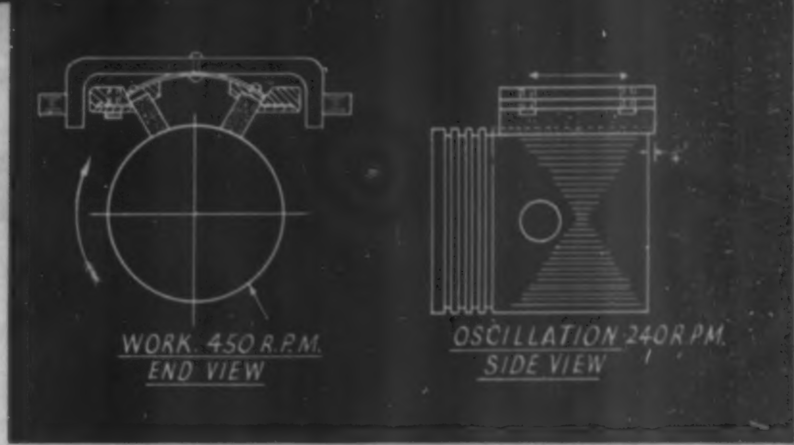

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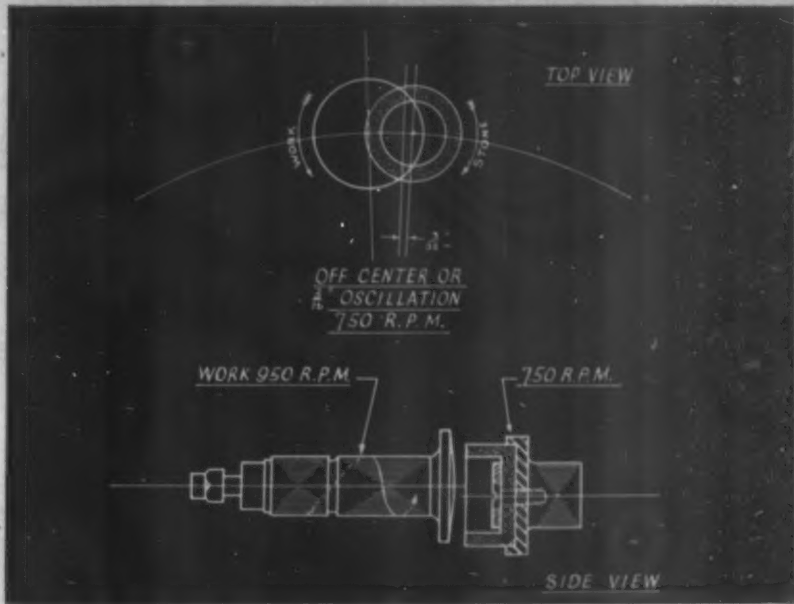

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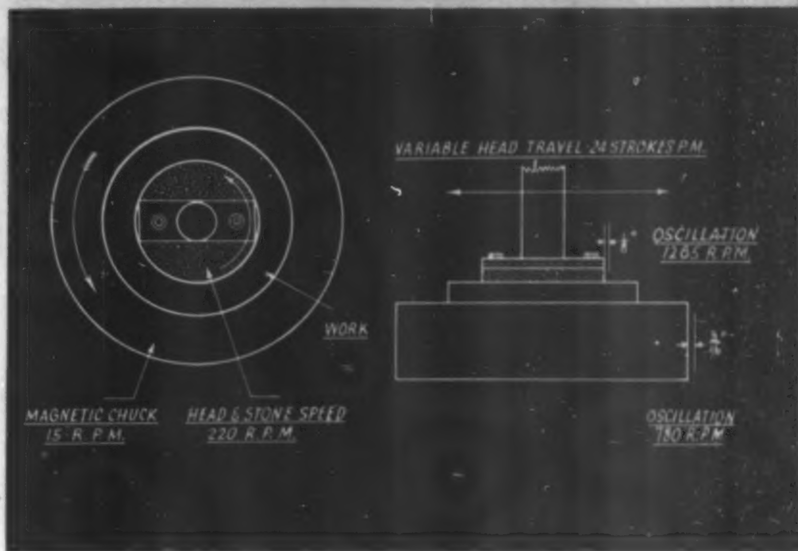
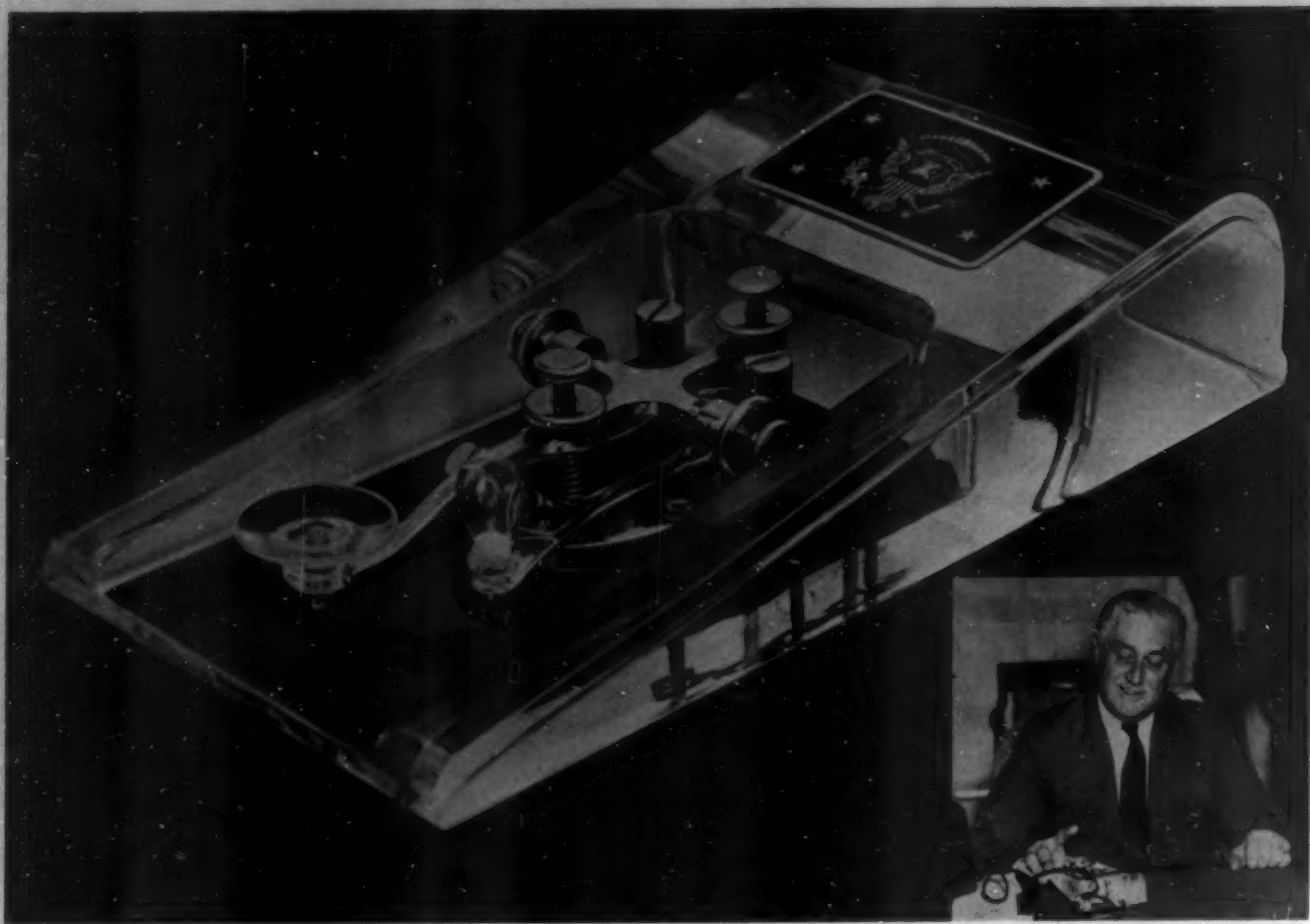


These diagrams outline the manner in which multi-motions are applied to automobile parts during the superfinishing process. Fig. 7 shows the relative position and motion of the work and stones in finishing pistons, and crank-shaft and cam-shaft bearings. A 14 spindle, automatic machine (Fig. 8) finishes 1400 tappet heads an hour. In finishing various flat surfaces (Fig. 9) both the work and stone holder revolve and oscillate on short strokes. The stone holder also has an adjustable traverse motion



President Roosevelt makes first use of the new plastic telegraph key presented to the White House by Western Union Telegraph Co. The key (shown above) was cut from a Lucite block and mounted on a Catalin base by Ortho Plastic Novelties, Inc. Engraving was done by Sheridan Nichols

NEW KEY FOR THE WHITE HOUSE

THE OFFICIAL WHITE HOUSE TELEGRAPH KEY went off the gold standard on April 26, 1939, when B. R. Allen, Washington superintendent of the Western Union Telegraph Co., presented to President Franklin D. Roosevelt a new clear transparent plastic key, which is to be used only by presidents of the United States on the many important occasions on which they officiate by proxy at distant ceremonies. Modern, attractive and uniquely designed, it replaces the famous old gold and nugget-studded key in use since 1909.

This new plastic key was used officially for the first time to "open" the doors of the Golden Spike Celebration at Omaha, Nebraska, commemorating the seventieth anniversary of the Union Pacific Railroad.

With the death of Edward W. Smithers, former chief telegraph operator at the White House, the official gold key, his personal property, came into the possession of his widow. In designing a new key, the company's engineers selected modern material that would give optimum visual effect, have excellent dielectric properties, durability and ease of fabrication. Water-clear methyl methacrylate, fragile in appearance, yet strong enough to be worked into an unusual shape, was found to be very adaptable. Chromium-plated, the key itself is mounted on a case of this clear plastic fabricated from cast acrylic sheet two inches thick. The same quartz-like material is used for transparent knobs and operating levers on the key. Inset in the top of the block is a silver plate on which is engraved the presidential flag in its colors of red, white and blue. Completely colorless, the plastic is a perfect setting for the bright ensign.

All wiring is concealed in the black cast resin base which further enhances the effect of mysterious remote control, as well as preventing any detraction from the beauty and smoothness of outline. Engraved on the side of the base is the inscription, "Presented to the White House by the Western Union Telegraph Company."

The telegraph industry has made use of plastic products for a wide variety of purposes, but this key is the only one of its kind, specificially designed for permanent White House official use—a distinctly novel serviceable application designed for today and tomorrow.

THE CHANGING PACE

by E. F. LOUGEE

Some startling advances which indicate the new trend in molding and laminating plastic materials

THE RAPID ADVANCEMENT IN METHODS AND technique being made in molding must be obvious even to the casual observer. To those engaged in the industry, it is a matter of considerable concern. Just where this will lead is anybody's guess but one thing is certain—it won't be long before radical departures from current methods will be common practice.

In a recent visit to shops in the East and Middle West, I saw phenolics and ureas being injection molded with all the speed and facility of production usually associated with acetate materials.

I saw an automatic compression press turning out perfect molded parts from a multi-cavity mold, hour after hour, with no more attention required than to put on a new drum of material when one was exhausted and remove drums from the press when they were filled with molded parts.

I saw automobile trunk compartment covers, nearly three feet by four feet, being molded experimentally from impregnated board.

I also saw sponge iron gears being molded on a quite ordinary preforming press.

I saw soybean meal being converted into yarn which has enough of the properties of natural wool, it is believed, to make it available as upholstery material.

Injection molding thermosetting materials

The most exciting demonstration, perhaps, was in the private laboratory of C. D. Shaw, an engineer who tells me he has spent the greater part of the past ten years perfecting an injection press that will handle phenolics and ureas with the same ease and facility as those on the market now handle acetate, acrylic and vinyl resins, which are thermoplastics.

He has succeeded so well that I saw ordinary standard phenolic molding compound, then paper-filled and canvas-filled phenolics fed into the hopper, one after the other with no cleaning period between, and promptly come out as finished products in a continuous cycle of about eleven seconds.

Following this demonstration, urea material was fed into the hopper, the heat reduced, and that molded equally well. At the same time it was explained that the machine would mold thermoplastics just as efficiently as it molds thermosetting materials.

One of the most interesting operations Mr. Shaw performed was to combine pearl urea with red and black phenolic by mixing them together and introducing them into the hopper at the same time. The most unusual effects resulted in the form of striated buttons. Of course no two buttons are exactly alike but by premixing the material mechanically, a uniformity of product would probably result to provide garment manufacturers with buttons of high style never before available in thermosetting materials. I have samples of these buttons in my office for those who care to see them.

Molding on this press is reported to increase the physical and chemical characteristics of both phenolics and ureas to such an extent that these properties are claimed to be improved in products turned out this way over those molded by the conventional compression method. The time cycle is shortened since the material reaches the mold cavity at exactly the right temperature to harden and requires but a few seconds to cure.

It is a known fact that in compression molding where presses are loaded with cold powder or preforms, a considerable portion of the molding cycle is occupied in warming the material and bringing it to the proper temperature to make it flow. The material itself is a non-conductor of heat which retards this process and if anything like a good cure is to be achieved, the press must remain closed and inactive until all the material has been plasticized and cured.

But in this injection press the powder, which needs no preforming, is being continually warmed from the time it is dropped through the hopper with controlled temperature in the heating cylinder until it is in exactly the proper condition of plasticity to enter the mold and set quickly. It is claimed that with small pieces such as buttons, the cycle can be cut from minutes to seconds in production.

Since the press operates as fully automatic equipment and handles comparatively inexpensive molding materials, cost comparisons with injection molded thermoplastics or even common compression molding are reported to be startling.

Revolutionary as this press appears upon observation, it doesn't necessarily indicate that it will replace compression molding nor throw present equipment into obsolescence when it reaches the market. It may, however, influence choice of materials for the type of jobs it can handle economically as soon as it is available for purchase. Meantime, kinks are being ironed out, cycles studied, products tested, and improvements and adjustments made before manufacture of the presses on a commercial scale is undertaken.

The course of this development, and of other presses along these lines which are rumored to be under construction, may reasonably be expected to follow somewhat the pattern of other injection presses. Three years ago there was hardly a handful of them in existence in the country and the biggest molded part possible to turn out weighed about an ounce and one-half. Now there are reported to be nearly eight hundred injection

Injection molded from standard phenolic and urea molding compounds, these buttons have greater density than when compression molded. The variations and striations shown are made possible by mixing different colored materials. The upper molding is a combination of phenolic and urea. The circular flash can be entirely eliminated in the molding but was allowed to form here to show the paper-thinness in which the compounds can be made to flow. Molded of Bakelite on an injection press developed by C. D. Shaw, these samples are on display in our editorial office

presses molding thermoplastics and capacities ranging from six ounces to thirty-six ounces per shot are available to molders according to their needs and demands.

The introduction of the multi-cylinder press about two years ago, stepped up the capacity of this type of molding so that comparatively large pieces, like the Chrysler glove compartment door, steering wheels and window frames, were made possible.

No one knows yet the limitation of capacity of the new press for thermosetting materials but Mr. Shaw, with the natural enthusiasm of the inventor, says there is no reason why furniture and other large objects cannot be molded this way since the material is so thoroughly plasticized when it enters the mold that it will flow anywhere it is directed provided there is sufficient pressure behind it to get it there before polymerization occurs.

Experimentation along these lines is going on in many plants, either with modified materials or improved heating arrangements for existing equipment. In the plant of a well-known injection press manufacturer, I saw samples of phenolic material and soybean plastic which had been molded, it was claimed, on a standard thermoplastic press. There was ample evidence that the material could be made to flow in this machine but its development has not progressed to the point reached by the C. D. Shaw machine.

The patent situation between the various new automatic presses is hard to predict. Claims and counterclaims are sure to pop up as soon as they appear on the market or get into commercial production.

The robot compression press

Rapid as the injection process appears to be, compression presses are being stepped up by automatic operation and there is no indication that they will be surpassed over any period of time.

Gordon Sayre, collaborating with George Scribner of the Boonton Molding Co., has built a robot press for compression molding. A drum of molding compound is attached at one end of the mechanism. From the other end, one and one-quarter inch bottle closures eject at the rate of 96 pieces every 63 seconds from an ordinary, standard 200-ton press.

"What we have done," says Mr. Scribner, "is to take a standard compression press and add automatic feed and control which takes the human element entirely out of the picture. The machine does just what men have done before, and does it better. The only difference is, that instead of having the preforming done in some other part of the plant, it is now done right at the machine and becomes a part of the molding process. Preforms are made in exactly the same manner. However, each pill is tailor-made. The pill in No. 1 preform cavity travels across the flat bed and drops into No. 1 cavity in the press. This is important from the material angle. A mold containing 96 seemingly identical cavities will produce, for example, finished pieces having a net weight varying from 4.6 to 5.2 grams.

"Made in volume at the rate of 350 a minute on a standard preform press, you would have to make all pills 5.4 grams because you don't know in which cavity they will eventually go.

"With each pill made to order for a specific cavity, flash can be regulated to minute control. Every pound of material purchased must be turned into molded parts because there is nothing else to do with it. You are no longer passing a drum of material through the pill machine in one department at 11 P. M., storing the pills until 10 A. M. the next day, transporting them to the press, handling them into the mold, with all the loss of powder by abrasion, light pills, even pills dropped on the floor—all that usually upsets your monthly inventory.

In the robot press, the molding powder is lifted from a trough where it flows from the drum, by conveyor to a weighing and distributing chamber. It then flows through tubes to individual buckets which at the right point in the molding cycle move forward and discharge their loads into the preform cavities, then return to their original position for a fresh load of powder.

As the die in the press closes, the preform press closes and remains closed almost as long as the main press. Preform dies are heated electrically so that the preform (when it is delivered to the die cavity) is thoroughly heated to a point which cuts the time required for the curing cycle nearly in half.

The preforms travel forward to the main press in conventional loading trays which operate automatically and are discharged flat into the cavities for which they were made. As the tray returns to receive a fresh load of powder from the "bucket brigade," the main press begins to close for the curing period.

Finished parts are ejected automatically with so little flash that no cleaning of the molds with compressed air is necessary. Either from habit, or as an extra precaution that no clogging takes place, the mold cavities are blown out manually with air about once every four hours —just for luck.

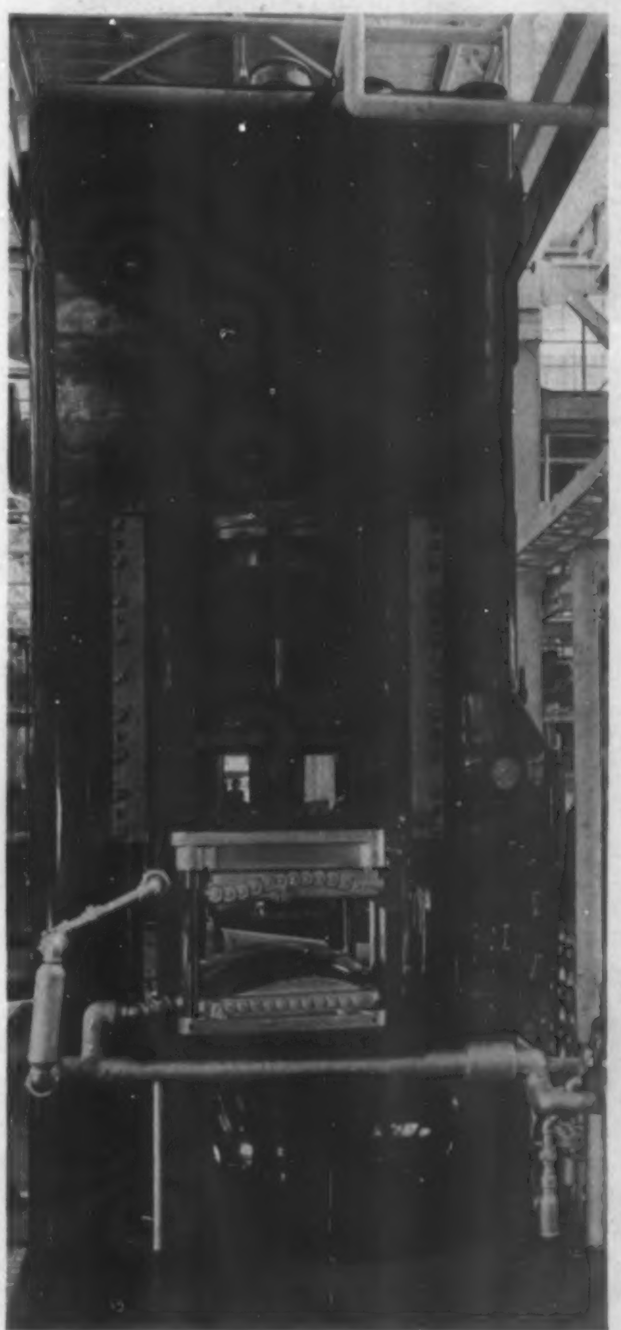
"We get 15 to 20 percent higher strength with this machine on bottle caps," says Mr. Scribner, "and the cost of their production is considerably reduced. We see no reason so far why one operator can't handle ten of these, which means a direct labor cost of about 10 percent of the present figure.

"We have found to our surprise and pleasure that we haven't made a bad piece on the new automatic in half a million caps, except for a few that were light. A bumble bee got into one of the feed tubes, for example, and cut down the supply of powder but that wasn't the fault of the press. Rejects have been reduced to less than one-tenth of one percent since the press has been operating. We began using it in production about April first."

The 200-ton press in use is operated by hydraulic line pressure with standard needle valves actuated by electrical controls and heated by steam as usual. Preheating is done by electricity and is also automatically controlled. The press has more red, green and amber lights than Broadway at Times Square and they are constantly flashing on and off as the controls operate. If anything serious occurs to prevent smooth operation of the press as a unit, a bell rings to warn the shop foreman, the press opens, the heat shuts off and the machine stops. Mr. Sayre wants to put on a phonograph record which will operate at this point and yell: "Hey, Joe! I need attention." Joe is the shop foreman's name.

Mr. Scribner does not believe that this press will take the place of all other presses. He says it does not lend itself to more than half the things they have to mold at Boonton. But for the type of work for which it was built, it is an important step in efficiency and economy. He feels that there is plenty of room for all the new presses now being developed and each will find its field of usefulness and bring the industry to a plane of much more practical and proficient production.

Sayre's approach to this problem has been so unique, both in general principle and in detail, that nothing in any way approaching it has ever appeared in the patent office, according to Mr. Scribner. Boonton has so much faith in the ultimate value of the press itself and the patent coverage that they have already doubled their molding room floor space and are constructing as rapidly as possible six more machines. *(Please turn to page 66)*



The 1200-ton press at the Ford Motor Co. in which trunk compartment doors are being experimentally molded for Mercury cars. Below the press opening, one of the molded doors may be seen. The mold, which is a two-ton casting, can be heated in two minutes and cooled in two minutes, molding the complete door in seven to ten minutes. When in production, these probably will be nested, molding from seven to ten at one closing of the press. Almost the entire surface of the piece is curved in contour, with an overall dimension of nearly 3 ft. by 4 ft. Bakelite-Rogers board is being used in the experimental work (See page 70 for further description of this development)

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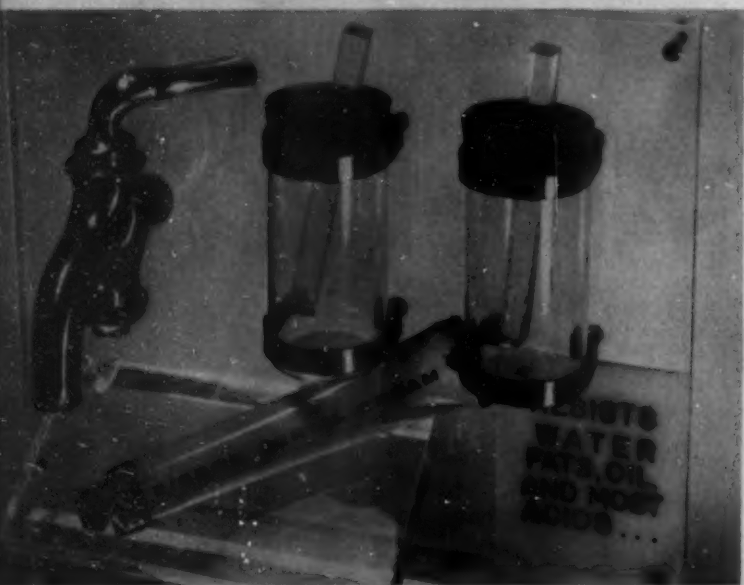

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ACRYLIC RESINS

TRANSPARENT PLASTICS HAVE SO IMPRESSED designers and decorators with their illimitable possibilities in decorative arts and interior architecture, that a few words illustrating their characteristics and indicating the simple methods of fabrication are not amiss.

To picture the description, we have chosen the exhibit of Röhm & Haas Co., currently displayed at PEDAC Galleries at the International Building in Radio City, where each of these operations is shown with actual materials.

While brilliant colorless transparency is the main attribute of acrylics, their light weight is perhaps a close second reason for their popularity. This is illustrated in Fig. 1, where two pieces of acrylic material are balanced by a single piece of glass—each piece being dimensionally the same.

These resins are not unbreakable, but their strength and resilience make them suitable to many applications where glass would be dangerous if a sudden impact should cause it to shatter. Acrylic resins will scratch more easily than glass but they will not shatter. That is the reason they are so generally used as windows in buses at the World's Fair. Fig. 2 shows that a hammer blow will not shatter the material nor cause it to fly when it breaks.

Resistance to oils, fats, water and to most acids, recommend it to many industrial and commercial uses.

Acrylic sheet is available in thicknesses from $1/16$ in. to $1\,1/2$ in. in sizes up to 20 in. by 50 in. Upon special order, smaller sized sheets to $2\,1/2$ in. thick can be prepared; also, sheets as large as 45 in. by 65 in. and 50 in. by 60 in., limited, however, to .100 in. to .375 in. in thickness. Rods, bars, tubes may be had in any reasonable diameter and are available from stock from $1/4$ in. to $2\,1/2$ in., either square or round. Figs. 4–5 illustrate several different sizes, forms and thicknesses.

Although acrylics in their original form are clear transparent, they may be dyed or pigmented to provide decorators with any hue or chroma. Some indications of density are shown in Fig. 6, but the real beauty of their translucence may be seen only in the actual samples. They look pretty flat in black and white illustration.

5 MATERIAL SHOWN HERE IS PLEXIGLAS

EASILY WORKED

The fabrication of acrylic sheets, rods and tubes is relatively simple once their physical characteristics are understood. Several common operations are illustrated in Figs. 7, 8, 9, 10. Beginning with Fig. 10, it is seen that the material may be drilled, threaded or carved with quite ordinary woodworking tools. Care must be exercised, however, in all operations involving friction because the material softens when heated. If the temperature of the material is increased to a very high point, the resin will become softened and will *drag* or flow. It will also fill up the working tools, making the continued operation difficult to perform. It is well, therefore, when drilling thick sections, to allow a small stream of cold water to flow directly in contact with the tool and the part being drilled, especially when power tools are being used.

Threading is comparatively simple once the cutting tool is in accurate position on the part to be threaded.

Carving is not so simple but can be accomplished with practice and experience to bring about remarkable results. A small grinding wheel is preferable for engraving operations and once the proper speed of the tool is determined, intricate designs may be formed.

Sawing may be done by power or by hand with standard equipment. The material is easily worked on a lathe with proper precautions against overheating and a sharp cutting tool should be used.

One of the most desirable advantages of acrylic rods and sheets is their ability to bend without cracking. Sheets can be shaped, when heated, to two and three dimentional curved sections. To do this successfully, the material should be brought to a temperature of 200 to 220 deg. F. by immersing in hot water in which a little common salt has been dissolved. For best results, the material should be shaped over a wooden form where it must stay until it returns to room temperature when it can be removed and will retain its new shape unless heated again.

We have explained that the material is easily scratched by contact with sharp particles or abrasion but this may be prevented to a considerable (*Please turn to page 74*)

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ALL PHOTOS COURTESY RÖHM & HAAS

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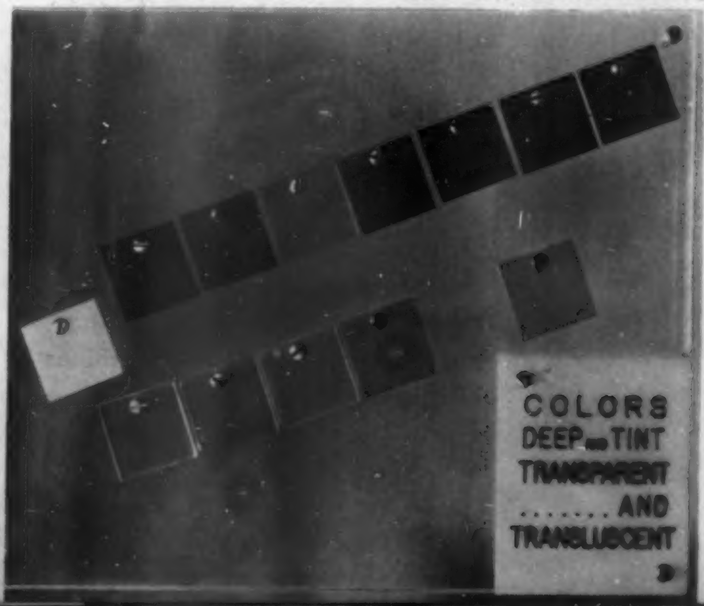

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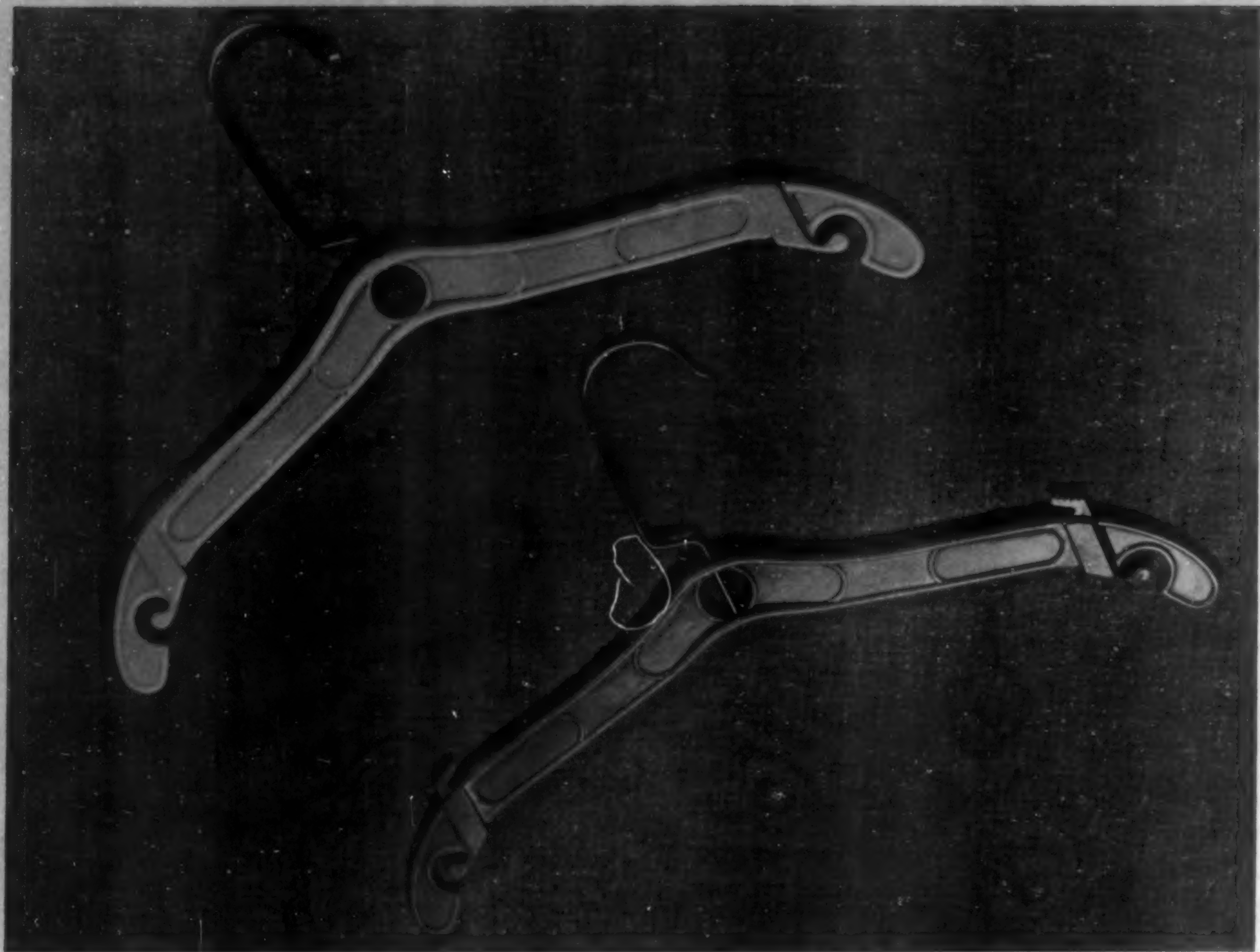

The "Magic-Hanger," shown with clips extended and concealed, is molded of Monsanto cellulose acetate by Plastic Molded Arts Co. on a Reed-Prentice injection press. Guy P. Harvey & Sons made the molds

HICKORY LIMB—1940 STYLE

by JAMES R. TURNBULL*

FORLORN AND FORGOTTEN IN THE FORWARD surge of scientific development has been one of the most important complements to modern urban life—the garment hanger. To say that there has been very little improvement over the hickory limb that shaded the old swimming hole may be a forgivable exaggeration. Certainly it is true that for the great majority of garments worn by women, the accepted styles of garment hangers on the market today are about as functionally unsound as it is possible to make them. Whether made of metal or wood, plain or covered with fabric, with or without crossbars—conventional hangers are satisfactory for only a limited number of the garments in a woman's wardrobe—such as coats, jackets and sleeved dresses. The multitudinous balance of skirts, slips, evening gowns, beach clothes, etc., must be pinned, thumb-tacked, knotted or otherwise mutilated in order to be successfully retained on the hanger.

There is no better place than a department store to discover at first hand this woeful lack in the modern scheme—and it was in a Trenton store of which he was merchandise manager, that James F. Fewster first conceived the basic principles of a hanger which he calls "Magic-Hanger" to end all hanger troubles. Once he started work, idea piled on idea, with the result that when the first handmade sample of the clever device was shown to an executive of one of New York's largest stores he exclaimed, "If this hanger could only answer the doorbell too, it would be a fine maid."

Naturally, when considering mass production, Mr. Fewster thought first of plastics. An analysis of the hanger reveals this amazing list of new features which make it almost fool-proof so far as the requirements of a majority of women's garments are concerned:

1. Specially designed rubber non-skid shoulder cushions

*Plastics Division, Monsanto Chemical Co.

for positive retention on the hanger of all coats, jackets, sweaters or sleeved garments.

2. The concealed spring lock guards elevated into position at the touch of a finger, to provide secure non-slip control for all types of strap and sleeveless garments.
3. Loops designed especially for hanging the skirts of two-piece suits or separate skirts will be a particular delight to every woman who has struggled with other types of hangers. Belt loops on the skirt fit securely into the hanger loops.
4. Molded of cellulose acetate the hangers are sanitary and easy to keep clean. There is no finish to wear off, no fabric covering to retain dust and peel or fade. The hangers can be cleaned with a damp cloth when necessary.
5. They are now produced in eight popular colors, a choice insuring the right color for almost any room decorative scheme.
6. The hangers are light yet strong. The one metal part, the hook, has been made unusually heavy to insure against bending under heavy garments.

Despite this impressive list, the appearance is simple and pleasing. The basic construction is modeled after that of a well-built bridge—with the strain of garment suspension counteracted by the heavy flanges at the top and bottom, while the center section wall is thin to reduce total weight. The clips are cleverly concealed when not in use. Spring triggers are released by inserting a thumbnail in the notches at each end of the hanger. In addition to transforming the closet life of a million American homes, Mr. Fewster also sees a great service for his new hangers in retail stores from coast to coast. He says, "From my own experience, I know that in many department stores, and specialty shops, hangers are a major problem. Whether considered from the standpoint of improving eye-appeal and display, or as a means of preventing costly mark-downs from garments dropped on the floor—these hangers should be a great help to many retailers."

Since the material can neither rust, corrode, splinter nor peel, its appearance in service is sure to be presentable over a long period of time. This is an advantage in the home as well as in the retail shop where unsightly hangers are incompatible with garments of style.

The fact that the cellulose acetate gives the hanger a flexibility not found in hangers made of other materials is a further advantage and its springy nature prevents its being bent out of shape.

To the unanimous question raised by everyone who sees the new hanger, "Why hasn't someone done this before?" might also be added the question, "How many more items of common use, such as garment hangers, can be transformed by inventive genius and the remarkable properties of plastics from non-descript products into sales Cinderellas?"

Away with thumb tacks, pins and half-hitches. Just extend the spring clips and any strap garment is on to stay (lower left). Note how skirt belt loop slips over molded hook (lower right) at top of the hanger

Designed by J. Gordon Lippincott, the Kreuger Brewing Co.'s new illuminated display sign, manufactured by George Rutledge Co., has three plastic parts molded by Boonton Molding Co. of colored translucent Beetle

PRACTICAL MOLDED DISPLAY

by J. GORDON LIPPINCOTT*

Colorful, illuminated display sign illustrates an appropriate use of plastic materials

BRILLIANT COLOR, DIRECT ILLUMINATION, AN eye-catching display sign—that's a triple threat to sales resistance. Prominently placed at every point-of-sale, a smart molded plastic illuminated sign demands extra attention and promotes sales of beer right at the bar. It makes use of the translucent quality and all-through color of molded urea resins as well as their lightweight, shatter-resistance and structural strength. Surprisingly enough, the unit was produced at a lower cost than anticipated due to simplicity in assembly and the limited number of finishing operations required.

The point-of-sale advertising field has had illuminated boxes of steel, wood and even cardboard for many years. These all required high labor cost in manufacture and assembly, with little or no tooling or die investment. The result was rectangular masses with hard lines—quite out of phase with current styling in other fields of design. The demand for flowing contours or the familiar "streamlining" led to new forms in the display industry and manufacturers were finding that more and more, tools and dies were needed to achieve an attractive sales unit. In this respect the display industry followed all manufacturing industries—the trend toward higher production of a carefully studied unit with comparatively high die charges and less labor in manufacture. The use of die castings appeared in many smart modern displays and then to a molded plastic was only a step.

No exact model of the finished unit could be made to show the actual effect of a translucent frame, although in the early stages of planning, a plaster study made a fair approximation. It was important, of course, that the plastic material be capable of withstanding heat from a lamp without discoloration (*Please turn to page 74*)

*Instructor in Industrial Design, Pratt Institute, Brooklyn, N. Y.

SIDELIGHTS ON PLASTICS IN EUROPE

By EMILE J. LUSTER

WHEN ONE LOOKS AT THE PLASTIC INDUSTRIES of Europe from a perspective based on two years study, one is impressed by the kaleidoscopic changes that are constantly taking place. Well-known existing materials are expanding into new channels of application and distribution, while new materials, processes, and developments are crowding each other in an endeavor to spread the gospel of plastics to a still larger world. Each new application as it comes out of the laboratories of Europe's chemical establishments presents a problem in itself, very often involving complicated chemical processes, new mechanical apparatus, and special production methods.

Although European hospitality is proverbial, it is a well-known fact that most manufacturers are reluctant to show their factories to strangers and especially to Americans. It has been my good fortune not only to come in close contact with many prominent manufacturers of various types of plastics, but I also had the somewhat coveted opportunity to inspect quite a number of plants producing basic materials as well as finished products. The general nature of my work kept me in continuous touch with the consuming trade.

It seems that Germany is still considered to be the fountain head in the development of new basic materials and processes; some call it the cradle of plastics. At the present time synthetic materials, and among them plastics especially, are almost a religion with the people. The education of the masses begins in early school life and interest is fostered by intensive concentration on handicraft work, using all types of plastic materials. Public lectures and demonstrations are the order of the day to keep up the interest. The most important influence is, of course, the stimulus given by the government in connection with the industrial four-year plan. Whenever and wherever possible synthetic materials take the place of natural products, of which there is a possible scarcity in the event of war.

Broadly speaking, the development of plastics and their application is influenced and depends to a large extent upon the temperament and the character of the people themselves. Germany is a country of research workers; they like to delve into and try new things, even new forms of government. They are susceptible to the peculiarities and requirements of their own as well as foreign markets. They adapt themselves readily to new conditions, adjust their goods and terms to suit the foreign customer and in doing so quite frequently step on the toes of other trading nations. Germany seems to be inoculated with the American germ of mass production and is very adept in changing processes and production methods to suit her own needs.

France is more a country of individualists. The French people value their own opinions and do not readily copy. Outside of strictly utilitarian or industrial articles they are somewhat resistant to mass production. This is particularly true in products of style, fashion, personal wear, ornaments, and novelties. They are past masters in styling such items as buttons, buckles, clasps, and dress and millinery ornaments. These applications are not usually produced on a really large scale, however, as each manufacturer seems to take personal pride in his own creation. That situation is gradually changing, largely due to the influx of refugees, who replace the craftsman with injection molding machines. France does considerable work in synthetic fibers and also in the treatment of textiles with various resinous solutions and remarkable progress is being made.

England is conservative and slow in adjusting itself to new conditions. The average Englishman's attitude toward new improvements and developments, whether they affect industry or the amenities of personal life, is best exemplified by quoting Alexander Pope, who said: "Be not the first by whom the new are tried, nor yet the last to lay the old aside." Compression molding practice moves along similar lines as in the United States, injection molding is being taken up rapidly, cast resins are in their infancy, and the application of liquid resins for various purposes progresses slower than on the continent. What strikes a student of plastics is the apparent resistance on the part of the average British molder to associate himself with plastic-minded industrial designers. With some notable exceptions the general run of molded products appears to have too many corners; there is little flow and unity of design. As a whole molded products are well made, but very often lack beauty of form and eye appeal. The tendency to replace otherwise useful articles with modernized ones serving the same purpose, is little developed. A group of young designers doing good work is quite active, but generally they do not receive sufficient support from the trade. Style of household goods, novelties, and ornaments, is distinctly influenced by American design. By tradition the British prefer trading to manufacturing, which accounts for the fact that most molded products except those used for general utility or industrial purposes, pass through many intermediate hands before they reach the consumer. Consequently really outstanding examples of molded art are too high in price to appeal to the general public. Further, the usual terms from wholesaler to molder extend over a period of time much longer than those from raw material producer to molder, with the result that the molder requires a relatively large investment. This condition has an adverse effect on the small man who, in many instances, is or would be the creator of new ideas and applications.

Italy, and also Russia, although not as creative in basic materials, are becoming (*Please turn to page 76*)

LONDON

AN OFFICE SUITE AS MODERN AND ATTRACTIVE in design and construction as the colorful plastic materials used, exemplifies some of the possibilities of plastic veneers and wall panels for interesting, functional architectural effects. Color schemes are subdued to the proportions and purpose of available space. Showcases, cupboards, architraves, floor trims, wall facings, doors and other details of practical and decorative equipment, finished in complementary plastic materials, correspond to the wall treatment.

In the managing director's office (Fig. 1) lower wall surfaces are faced with plastic panels in two tints of pale buff, arranged in horizontal continuity by means of narrow copper-colored aluminum trims. An electric clock fabricated in laminated material, flush with the background, is mounted over a semi-circular panel, Chimney breast, dressed with convection heater, mantel, door and floor bordering are finished in the same material.

Simple wall paneling in vertical convex units of laminated board faced with dull-finished buff veneer, spaced by vertical teak fillets provides decorative integrity and restraint in the board room (Fig. 2). Uniform spacing between false windows is faced with same convex panels enclosing recesses utilized as cupboards. Table, too, is surfaced with a harmonizing veneer.

A decorated panel, embodied in the secretary's room (Fig. 3) represents the first example of marquetry or inlaid work executed in veneers of various colors.

A typical section of the general offices (Fig. 4) shows inlaid door design and the method of mounting wall panels. Lettering for doors is cut from decorative plastic sheeting and applied with special adhesive.

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INTERIOR

The walls of the executive reception room (Fig. 5) are wainscotted with narrow buff-colored panels, butt-jointed and crowned by an upper margin with square incisions at each vertical joint, and trimmed at the bottom with slightly recessed skirting in brown. Lower part of each panel is dressed with two overlaid squares of dull pink, arranged one above the other, leaving a margin on all sides. Exposed portions of receptionist's desk, except for the teak surround, are finished in veneer.

Fig. 6 shows a section of the main vestibule, combining reception room and small exhibition, the walls of which are surfaced with decorative plastic sheeting. Furniture, showcases, etc., are finished to match. A portion of the executive waiting room (Fig. 7) further illustrates legitimate variations of decorative technique.

It is interesting to note that plastic materials, because of their hygienic and moisture-resisting properties are particularly valuable for the treatment of lavoratories (Fig. 8) where, frequently, a variety of different materials are used that are difficult to combine successfully.

The designs for these new London offices of Bakelite, Ltd., are the work of Oliver P. Bernard, F. R. I. B. A., and a variety of Bakelite materials are used throughout. The aim in this case was to make a new process in plastics a subservient rather than assertive feature of interior decoration. An attractive but not ostentatious environment was intended without stressing the presence of a material of which the occupants need no constant reminder. One of the important advantages from the viewpoint of progressive design is the versatility of the medium which invites new methods of treatment both in design and construction.

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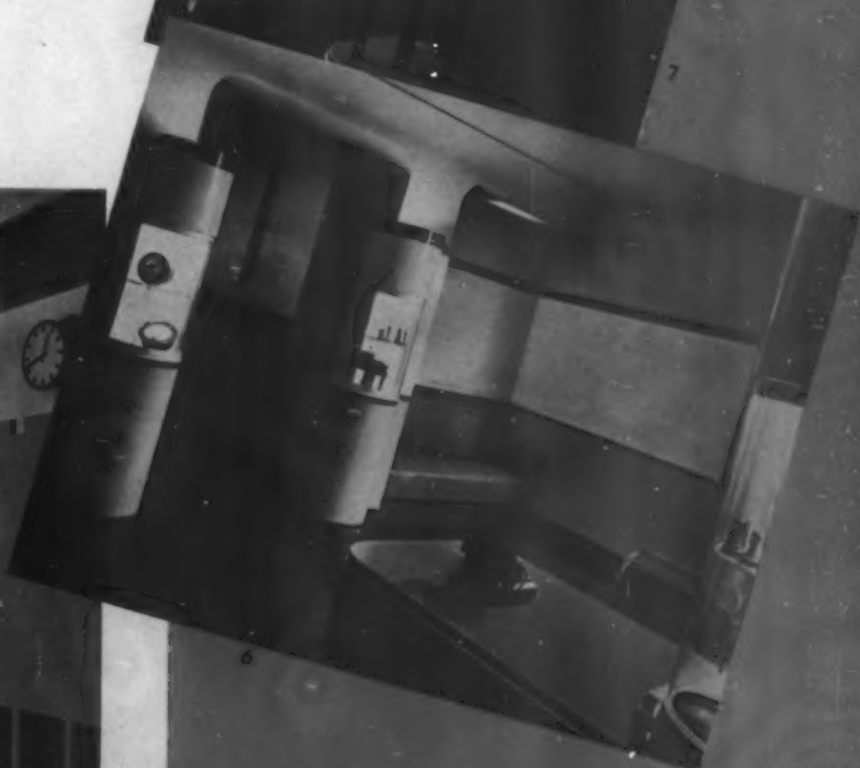

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Gas Ranges for

Above: "Monitor" Universal Gas Range, manufactured by Cribben and Sexton Company, Chicago, Illinois.

★ ★ ★

At Left: Door Handle Posts, Minute Minder with Condiment Jars and Burner Control Handles made of Molded Plaskon. Moldings by Eclipse Moulded Products Company, Milwaukee, Wisconsin, and National Lock Company, Rockford, Illinois.

Glamour Girls

JUST TEN YEARS AGO the first glorified gas range was announced to America's housewives. Immediately, the home kitchen began to lose its drabness. Cooking became a pleasure. The gas range industry took on new vigor, greater activity.

That was only the beginning of a long list of improvements that have transformed the old, black, cast iron models, with their gaudy nickeled trimmings, exposed pipe, valves and bolt heads, into the present day streamlined, all-enameled types with artistically designed fittings of colorful, Molded Plaskon.

There are many reasons why Molded Plaskon is highly preferred for gas range fittings. It has great strength—resists breakage. It will not tarnish, rust, corrode or chip. Being solid molded color, the finish is permanent—retains its luster. Scratching or abrasion do not injure its color value.

Plaskon is a sanitary material, as well. The surface is smooth, hard and easy to clean. Plaskon is tasteless, odorless, inert. It resists water, grease and all food oils. In addition, Plaskon has exceptionally low heat transference. Delicate fingers aren't burned when they touch a Plaskon handle or valve control. Nor are these Plaskon fittings affected by high cooking temperatures.

Plaskon may be had in an unlimited variety of clear, clean, fadeless colors. These range from purest white through dainty pastels and brilliant hues to deepest black, from a high degree of translucence to complete opacity.

Plaskon's many unique advantages have made it the world's largest selling urea-formaldehyde plastic.

If you are considering plastics in your program of product improvement, we shall be glad indeed to send an experienced Plaskon representative to confer with you. No obligation! Plaskon's facilities for research, design and engineering are unequalled in the plastics industry.

PLASKON COMPANY
Incorporated

2121 SYLVAN AVE. TOLEDO, OHIO

Canadian Agent: Canadian Industries, Limited, Montreal, P. Q.

Trade Mark Registered

PLASKON

★ MOLDED COLOR ★

PLASTICS IN REVIEW

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1. Clip this waterproof cigaret case to your belt or trunks and you can swim out to the float and enjoy a smoke. It is made of Catalin in nine different colors with layer of cork cemented to the cover. La Mode Plastic Co. furnish a lighter with each case

2. Colorful, lightweight pedestals for trophies manufactured by International Silver Co. are molded of Textolite by the Plastics Dept. of General Electric Co. From three carefully styled parts which can be interchanged or pyramided, nine different bases are provided

3. Peek through the window, rotate the knob and Pathegrams' Cine Vue flashes miniature views of the World's Fair. Molded by Consolidated Molded Products Co. of Arcolite phenolic, two parts are carefully fitted together. Sprocket operating the film and outside knob attached to it are injection molded of Tenite

4. Ultriplex Machine manufactured by Burdick Co. is used for electrical treatments. Electric pad holder frame may touch any part of the body without fear of short circuit or direct electrical contact. Frame, handles, plastic control board fixtures are all molded by Eclipse Moulded Products Co. of Durez

5. Featherweight, non-inflammable Bandit eye shield provides all-around vision through smoky-tone Plastacele. Plastic ear pieces are molded by A. L. Hyde for Maxim Instrument Co. Molds are by August Frank

6. Beer scrapers await the next round in an eye-catching Lilliputian bar, complete in every structural detail, distributed by F. & M. Schaefer Brewing Co. General Products Co. molded

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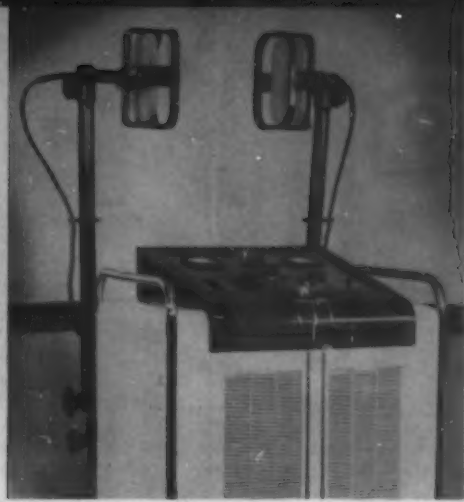

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this novel receptacle of brilliant red Plaskon. Rail and glass holder are chromium-plated metal

7. Nail polish, creams, oils, files and complete manicuring accessories fit in compartments of a light portable tray molded by Mack Molding Corp. for Revlon Products Corp. of Beetle

8. Many an unwary minnow will meet an untimely end in the "Sure Catch" transparent bait trap manufactured by Acme St. Louis Co. of Vue-Pak and Lumarith. It is practically invisible as polished cellulose acetate surface reflects much the same as water. Frame is rust-proof

9. Because it can be bent easily when heated, acrylic sheet offers decorators an exciting new material for unusual design. This coffee table displayed at PEDAC, Radio City, is made entirely of Plexiglas

10. Hotel and Club "souvenir" hunters shun the 7-in. diameter Smoke Master ash tray. Raised projection has slot for packet matches, two rests for cigars or cigarets, small circular recess to hold metal indentification or trade mark insert. Harry Davies Molding Co. produce it in various shades of Bakelite or Durez

11. Bell-shaped hinged wedding ring box, with floral-decorated top neatly fits the best man's vest pocket. Norton Laboratories, Inc., mold this of Bakelite urea in dainty pastel shades

12. These Lucite lenses are shown attached to the sprue just as they come from the injection press. They were molded for gas masks by Firestone Tire & Rubber Co. (Plastics Division) on a Lester press

Manufacturers addresses will be sent if you will write to the Editor enclosing 3-cent stamp for reply. Many of these items and others pictured throughout this issue are on display in our editorial offices during this month

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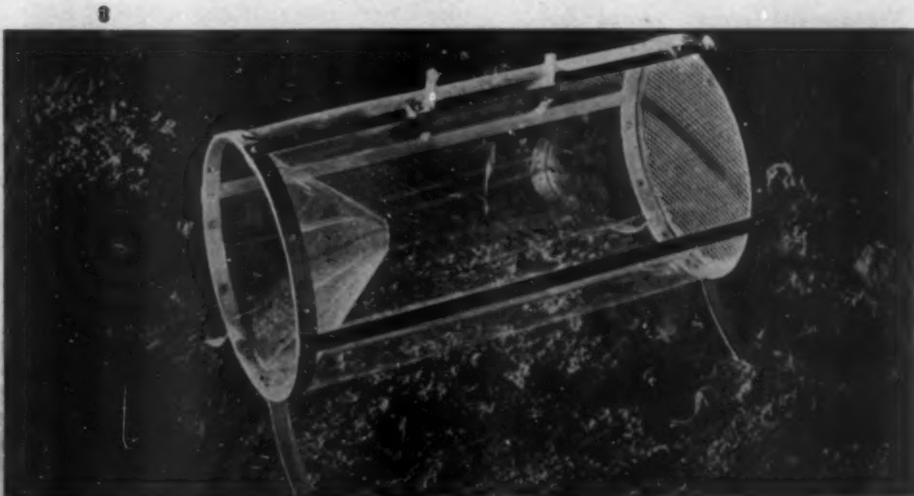

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13. New version of the transparent pump oiler has an adjustable swivel spout. Universal Plastics Corp. mold this oil can of Monsanto cellulose acetate in clear, red, green, yellow and blue for Eagle Manufacturing Co.

14. Gemstone umbrella handles in brilliant colors are fabricated by H. M. Musser & Co., Inc., for Follmer, Clogg & Co. Ornamentation is by hand-carving and engine turning which produces the fine lines and block effect. Then they are hand-tinted with colored enamel and trimmed with cord and bead

15. Sturdy trigger guard used in Model A-1 guns manufactured by Marlin Firearms Co. is molded by Watertown Manufacturing Co. of black Tenite

16. Translucent street lamps installed by Gardens Corp., Forest Hills, L. I., according to architectural specifications by Fellheimer and Wagner are of laminated Bakelite made by Lamicoid Division of Mica Insulator Co. Lower in height than normal street lighting fixtures, they cast a warm glow without glare or dark pavement shadows

17. Gay transparent table mats, distributed by Ellison & Spring, Inc., bring cool freshness to the luncheon table. Roses, lilies and tulips are printed from hand-painted patterns on 12 in. by 18 in. Lumarith sheets

18. Swing out with two new registered model golf clubs made for A. G. Spalding Co. Black golf club ferrules are injection molded by General Electric Co.'s Plastics Dept. of Textolite

19. Double decks of Kem Plastic Playing Cards and their colored plastic boxes are displayed in a cellulose

PLASTICS IN REVIEW

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acetate case with transparent cover made of Duranol by Joseph H. Meyer Bros. Patented gold acetate covered metal wire beading decorates and strengthens the display

20. Non heat-conducting oven heat control is molded of Durez by American Insulator Corp. Wiped-in white enamel lettering contrasting with deep black finish is easily read

21. Classic contours, smooth ivory finish attract attention to Dennison Manufacturing Co.'s spring-hinge watch case molded in both Beetle and Plaskon by Auburn Button Works, Inc. White satin, lining the cover, contrasts with dark velvet bordered by light corded material. Wiped-in design around lower inside edge adds to the jewel-like effect

22. Souvenirs of Golden Gate International Exposition are made of Bakelite, Plaskon and Catalin materials by American Molding Co. Farrington Products Co. distributes light-colored coaster, spherical bottle stopper, and cast resin key tag and brooches. Other coasters are automatically molded on a Stokes press at the Fair

23. A flick of the Cardineer Wheel and any one of 1500 index cards is at your finger tips. Desk model, $6^{1}/_{4}$ in. in diameter is molded in two sections by Chicago Molded Products Corp., of brown mottle Durez

24. "Carterite" tray is made by Dispersion Products, Inc., under a patented process which allows the addition of resin or plastic directly to pulp in the paper beater. This can be sheeted over a paper machine or formed on a pick-up molding machine. Strength is obtained without fraying or separation of laminations

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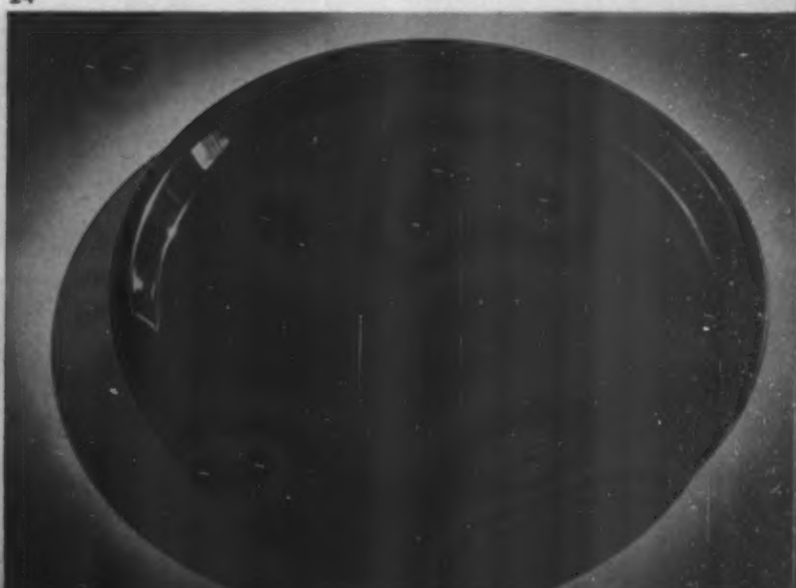

SWEEPING PROGRESS

Additional plastic parts and an entirely new motor housing are included the new Hoover model

THE FIRST USE OF PLASTICS IN THE HOOVER Company's One Fifty Cleaning Ensemble (MODERN PLASTICS, November 1936) was the result of three years' research for material that would be light in weight, strong, have permanent color and luster, good electrical insulation and allow for the economical design of complex shapes. This model, then radically new, combined molded phenolic motor hood, motor case, ventilating fan, agitator ends, bag connector flange, handle plug, receptacle and some small parts with the other apparatus made of die-cast magnesium and aluminum alloys. Each molding was the ultimate development of a series of preliminary designs and tests. Special molding materials were used to secure certain properties in individual parts.

For the unique molded hood, extra-strength material was developed which, in combination with reinforced ribbing on the inside, produced a rugged molding that withstands more than ordinary abuse in service. The lightweight motor case, allowing for close dimensional tolerances, assured accurate assembly and alignment of bearings, carbon brushes and field core. Accessory tools were all designed to tie up into one complete, efficient and harmonious unit.

Later models varied the design of the motor hood, included molded cleaning tools, sweeper nozzles, wheels and more molded phenolic internal parts, all of which contributed to the cleaner's lightweight, noise reduction, self-insulation and toughness, as well as styling.

Like its award-winning predecessor (MODERN PLASTICS, November 1937), the "305" introduced February 27th, owes much of its graceful, practical design, durability and high dielectric strength to the phenolic material used. Its scratch-proof hood is molded with an opening at both ends—one in front for a light to illuminate dark corners, and one at the rear into which the handle shaft fits—eliminating the ugly swinging bracket which broke the smooth line of the design. The company's name is molded on the top of the hood, the vertical lettering further enhancing the modern, flowing effect which is carried up by the shaft and the red striping on the canvas bag.

The motor casing, completely different from previous models, is molded in two halves which conform to the shape of the streamlined hood. Besides actual saving in poundage due to over twenty-five plastic parts, simplicity of design reduces molding costs.

The 1939 cleaner, with its impressive array of practical attachments, has been planned to satisfy the homemaker's demand for a sweeper that is light enough to manipulate without "back-breaking" and durable enough to stand years of rough wear and hard knocks without losing its "showroom" appearance.

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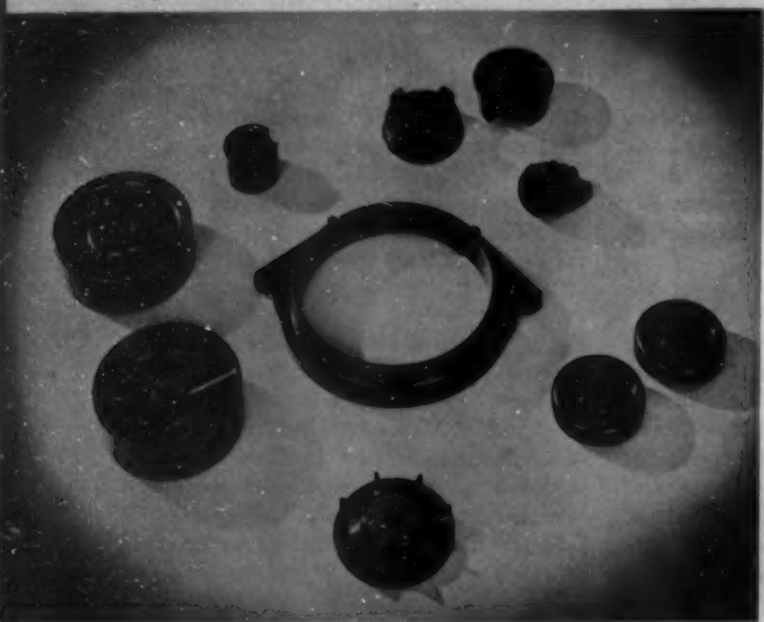

Fig. 1—Small parts of the Hoover electric vacuum cleaner shown are molded of Durez. Fig. 2 illustrates the one-piece black motor housing and the two halves of the motor casing, all of the same material. Fig. 3—Completely assembled model, designed by Henry Dreyfuss, is as trim and efficient in appearance as in function

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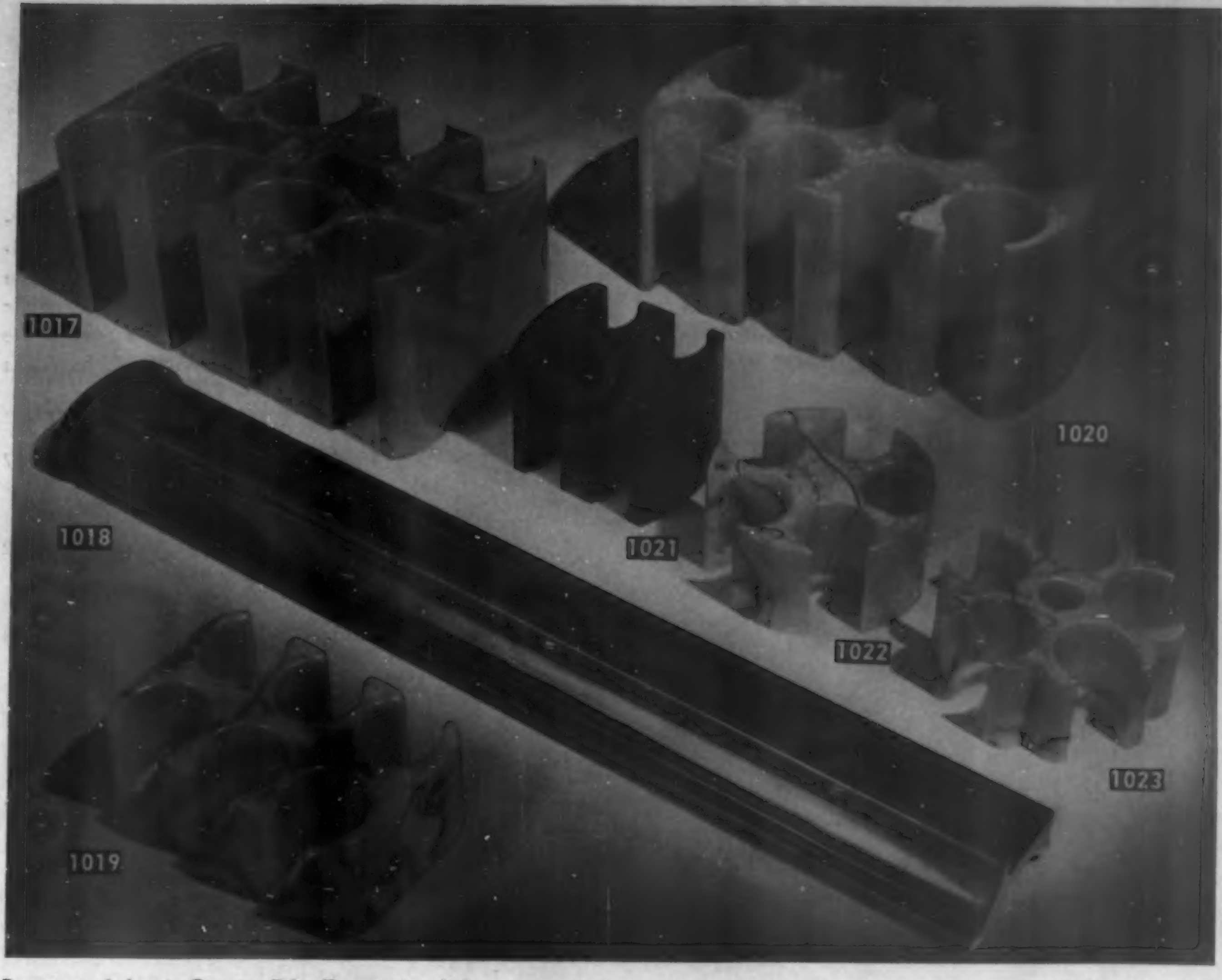


Reprints of sheets One to Fifty-Two in book form, twenty-five cents in coin or stamps

Cast Resin Forms

SHEET EIGHTY-ONE

A variety of colorful, durable cast resin racks in mottled tones are quickly and economically produced. Forms cast in single or multiple units are easily machined and finished to a high, smooth luster. They are ready for delivery to fabricators to be finally polished and assembled

1017. Poker chip rack, 7 1/2 in. long by 4 1/8 in. wide, 3 3/8 in. high. Weighs 1.95 lbs. Holds 200 regulation chips. Compartments, 3 in. by 3/4 in., hold two decks of cards

1018. Tile rack for characters in Chinese tile game. Weighs .78 lbs. Measures 16 1/4 in. long

1019. Poker chip rack for 150 chips of 1 1/8 in. diameter. Dimensions are: 4 1/4 in. long by 2 3/4 in. wide by 1 5/8 in. high. Weighs .41 pounds

1020. Poker chip rack for 200 regulation chips, 1 9/16 in. in diameter. Weighs 1.65 lbs. Dimensions are: 7 3/4 in. long by 3 1/2 in. wide by 3 1/4 in. high

1021. Money rack used in Chinese tile game for chips of 7/8 in. diameter. Dimensions are: 2 7/8 in. long by 2 1/4 in. wide by 2 1/4 in. high

1022. Circular poker chip rack for 100 chips of 1 1/8 in. diameter. Weighs .33 lbs. Measures 1 9/16 in. high, 3 3/8 in. in diameter

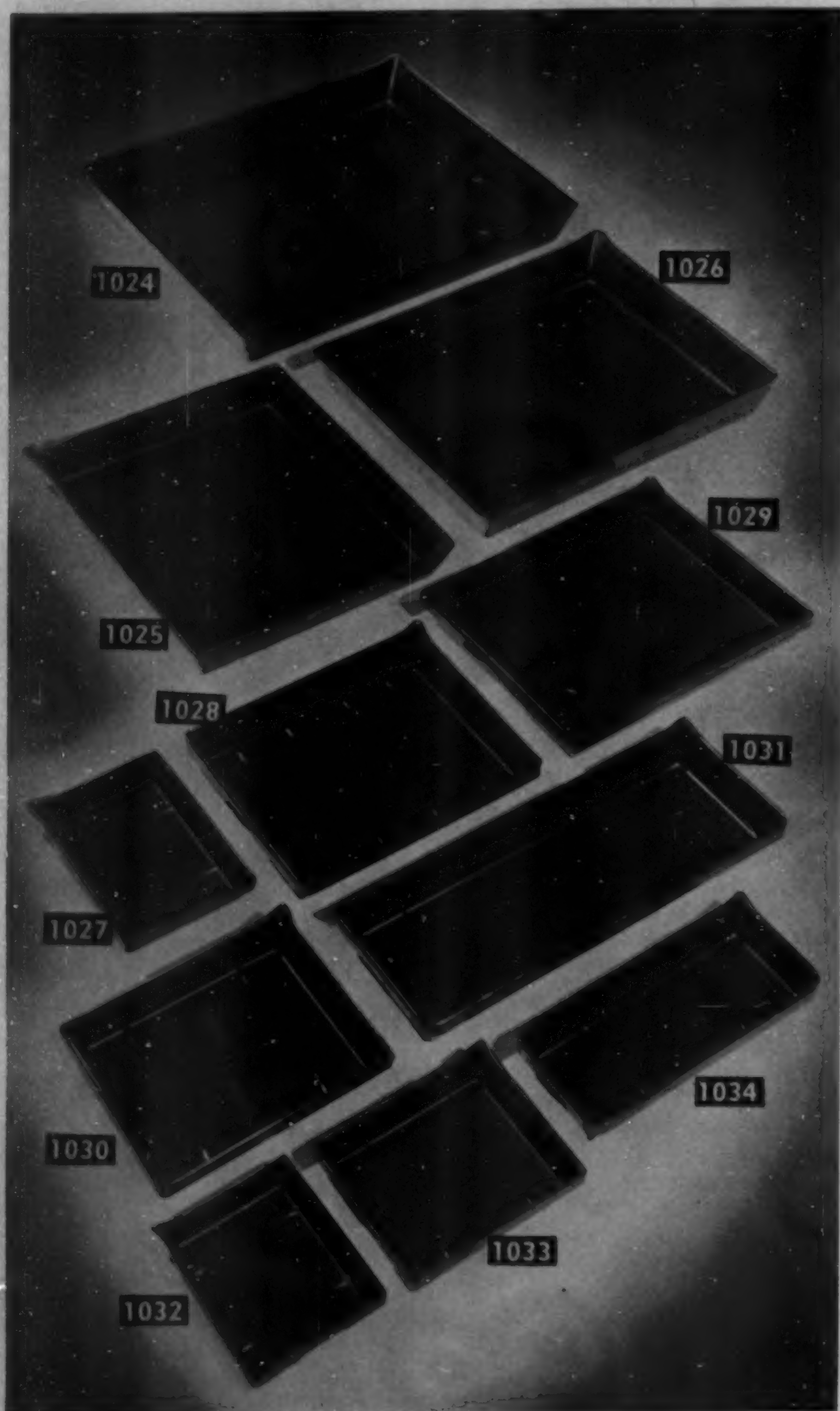
1023. Circular poker chip rack with hole through center. Outside diameter is 3 3/8 in., 1 1/2 in. high. Weighs .23 lbs. Hole measures 5/8 in. in diameter. Holds 100 chips of 1 1/8 in. diameter

Address all inquiries to Stock Mold Department, Modern Plastics, Chanin Building, New York City. All molders are invited to send samples from stock molds to appear on this page as space permits

Stock Molds

SHEET EIGHTY-TWO

Print-size photographic developing trays, manufactured of a specially developed shellac-type thermoplastic compound are available from stock molds, without mold cost. Impervious, of course, to all acids used in the photographic field, the material is heavy, inexpensive and sturdy. It can be had in black only. Molded ridges in the base of each tray allow easy removal of negatives from the bottom without scratching plates. Rib around the rim, tapering in a pouring lip at one corner, facilitates stacking and strengthens edges



1024. Developing tray, 14 in. wide by 17 in. long

1025. Developing tray, 10 in. wide by 12 in. long

1026. Developing tray, 11 in. wide by 14 in. long

1027. Developing tray, 4 in. wide by 5 in. long

1028. Developing tray, 5 in. wide by 8 in. long

1029. Developing tray, 8 in. wide by 10 in. long

1030. Developing tray, 7 in. wide by 9 in. long

1031. Developing tray, 4 in. wide by 14 in. long

1032. Developing tray, 3 in. wide by 4 in. long

1033. Developing tray, 4 in. wide by 6 in. long

1034. Developing tray, 3 in. wide by 8 in. long

Address all inquiries to Stock Mold Department, Modern Plastics, Chanin Building, New York City, giving item and sheet numbers. All molders are invited to send samples from stock molds to appear on this page as space permits

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A.S.T.M. METHOD FOR TESTING THE RESISTANCE OF PLASTICS TO CHEMICALS

THE AMERICAN SOCIETY FOR TESTING MATErials at its annual meeting held in Atlantic City during the week of June 26 adopted a Tentative Standard Method of Testing the Resistance of Plastics to Chemical Reagents. This method is one of two presented for the action of the Society in the annual report of Committee D-20 on Plastics. The other method relates to the determination of the index of refraction of transparent organic plastics and will be published in an early issue of this journal. These two methods are the first developed by the committee since its organization in 1937.

The five subcommittees of Committee D-20 held brief meetings at Atlantic City on June 28 to take further action on a number of other testing methods which are nearly ready for adoption. Included among these are procedures for strength, hardness, flow under molding conditions, changes on heating, flammability, other optical tests, and tests for resistance of plastics to light, heat, and moisture.

The complete text of the method developed by the Subcommittee on Permanence Properties of Plastics is presented herewith.

Tentative Standard Method of Test for Resistance of Plastics to Chemical Reagents

Scope:

1. This method is intended to apply to the testing of all organic plastic materials, including cast, hot molded, cold molded, laminated resinous products, and sheet materials. It includes provisions for reporting changes in weight, dimensions, and appearance, but does not cover changes in strength characteristics, electrical properties, and the like. It is intended that the effect of chemicals on these latter properties shall be determined by making measurements on the standard specimens for such tests before and after immersion in the reagents listed herein. In using this method to evaluate the resistance of plastics to chemicals it is recommended that the impact strength of the plastics before and after immersion in the selected reagents also be determined and reported.

Apparatus:

2. The apparatus shall consist of an accurate chemical balance, containers for test specimens and a cabinet for maintaining a temperature between 77 deg. F. (25 deg. C.) and 86 deg. F. (30 deg. C.)

Standard Reagents:[1]

3. (*a*) *Sulfuric Acid (30 per cent)*.—Slowly add 199 ml. (366 g.) of H_2SO_4 (sp. gr. 1.84) to 853 ml. of water.

(*b*) *Sulfuric Acid (3 per cent)*.—Slowly add 16.6 ml. (30.6 g.) of H_2SO_4 (sp. gr. 1.84) to 988 ml. of water.

(*c*) *Sodium Hydroxide Solution (10 per cent)*.—Dissolve 111 g. of NaOH in 998 ml. of water.

(*d*) *Sodium Hydroxide Solution (1 per cent)*.—Dissolve 10.1 g. of NaOH in 999 ml. of water.

(*e*) *Ethyl Alcohol (95 per cent)*.—Undenatured ethyl alcohol.

(*f*) *Ethyl Alcohol (50 per cent)*.—Add 598 ml. (482 g.) of 95 per cent undenatured ethyl alcohol to 434 ml. of water.

(*g*) *Acetone*.

(*h*) *Ethyl Acetate*.—Containing 85 to 88 per cent ester.

(*i*) *Ethylene Dichloride*.

(*j*) *Carbon Tetrachloride, c.p.*

(*k*) *Toluene*.

(*l*) *Gasoline*.—Straight type without addition of lead compounds or benzene.

(*m*) *Sodium Chloride Solution (10 per cent)*.—Add 107 g. of NaCl to 964 ml. of water.

(*n*) *Distilled Water*.—Freshly prepared.

Supplementary Reagents:[1]

4. (*a*) *Nitric Acid (10 per cent)*.—Add 108 ml. (153 g.) of HNO_3 (sp. gr. 1.42) to 901 ml. of water.

(*b*) *Hydrochloric Acid (10 per cent)*.—Add 239 ml. (283 g.) of HCl (sp. gr. 1.19) to 764 ml. of water.

(*c*) *Acetic Acid (5 per cent)*.—Add 48 ml. (50.5 g.) of glacial acetic acid (sp. gr. 1.05) to 955 ml. of water.

(*d*) *Oleic Acid, c.p.*

(*e*) *Ammonium Hydroxide (10 per cent)*.—Add 375 ml. (336 g.) of NH_4OH (sp. gr. 0.90) to 622 ml. of water.

(*f*) *Sodium Carbonate Solution (2 per cent)*.—Add 55 g. of $Na_2CO_3.10\ H_2O$ to 964 ml. of water.

(*g*) *Hydrogen Peroxide Solution (3 per cent, or U.S.P. 10 volume)*.—Add 98 ml. (108 g.) of commercial grade (100 volume or 28 per cent) hydrogen peroxide to 901 ml. of water. (*Please turn to page 78*)

[1] Directions for preparation of reagents are for approximately 1 liter quantities. All percentages are by weight.

PRODUCTION AND SALES OF SYNTHETIC ORGANIC CHEMICALS IN UNITED STATES, 1938

THE TARIFF COMMISSION'S PRELIMINARY STAtistics of United States production and sales of synthetic organic chemicals in 1938 reveal that sales of all synthetic organic chemicals decreased 13 per cent, from $284,000,000 in 1937, a year of peak chemical sales, to $246,000,000 in 1938. The groups that were off the most in sales value are coal-tar resins and dyes. Sales of non-coal-tar resins increased. The unit values of a number of the groups, particularly dyes, medicinals, and non-coal-tar resins, were higher in 1938 than in 1937. The principal factor in such increases was the relatively greater sales of higher-priced items within the groups. The generally greater decline in production than in sales, both by quantity and value, indicates that during 1938 producers of synthetic organic chemicals reduced inventories carried over from 1937, and a substantial part of the output of synthetic organic chemicals is consumed by further processing.

The decline in synthetic resins was in those of coal-tar origin, which were 25 per cent less in production, 107,000,000 pounds in 1938, and 23 per cent less in value of sales, $16,000,000 in 1938, than in 1937 (see MODERN

Table I.—Comparison of United States production and sales of synthetic organic chemicals, 1925–30, 1937, and 1938 Differences between the quantities of production and sales are due primarily to consumption by producing concerns.

		1925–30 average	1937	1938	Decrease 1938 from 1937
Coal-tar Chemicals					*Per cent*
Intermediates:					
Production	Thousands of pounds	267,492	575,893	401,943	30.2
Sales	Thousands of pounds	109,133	242,194	171,514	29.2
Sales value	Thousands of dollars	22,408	35,639	26,090	26.8
Finished coal-tar products:[1]					
Production	Thousands of pounds	138,078	[2]373,063	275,203	26.2
Sales	Thousands of pounds	133,964	[2]315,742	244,066	22.7
Sales value	Thousands of dollars	65,027	[2]128,736	103,769	19.4
Dyes:					
Production	Thousands of pounds	94,003	122,245	81,326	33.5
Sales	Thousands of pounds	92,207	118,046	87,284	26.0
Sales value	Thousands of dollars	39,428	64,613	53,011	18.0
Medicinals:					
Production	Thousands of pounds	4,508	14,800	11,097	25.0
Sales	Thousands of pounds	4,106	11,989	8,885	25.9
Sales value	Thousands of dollars	7,464	11,496	9,509	17.3
Flavors and perfume materials:					
Production	Thousands of pounds	3,966	4,356	3,795	12.9
Sales	Thousands of pounds	3,919	3,907	3,618	7.4
Sales value	Thousands of dollars	2,901	3,983	3,283	17.6
Coal-tar resins:					
Production	Thousands of pounds	[3]24,442	[2]142,025	106,923	24.7
Sales	Thousands of pounds	[3]22,135	[2]109,201	84,763	22.4
Sales value	Thousands of dollars	[3]7,756	[2]20,582	15,811	23.2
Non-coal-tar chemicals					
Production	Thousands of pounds	379,972	2,529,650	2,409,418	4.8
Sales	Thousands of pounds	264,006	1,168,149	1,121,569	4.0
Sales value	Thousands of dollars	44,499	119,420	115,933	2.9

[1] Includes color lakes, rubber chemicals and miscellaneous coal-tar products not shown separately.
[2] Does not include resins from adipic acid, coumarone and indene, hydrocarbons, styrol, succinic acid and sulfonamides.
[3] 1927–30 average.

PLASTICS *15*, 41–42, July 1938). Non-coal-tar resins increased 11 per cent in production to 23,000,000 pounds, and 24 per cent in value of sales to $7,000,000, partly as a result of commercial production of the relatively high-priced vinyl acetals for use in safety glass manufacture. Urea resins are shown separately for the first time.

Table 2.—United States production and sales of certain synthetic resins, 1938

	Production	Sales		
	Pounds	Pounds	Value	Unit Value
(A) Coal-tar: Total	106,923,244	84,763,503	$15,810,538	$0.19
Alkyd resins:				
Maleic anhydride	3,432,887	2,978,718	634,935	.21
Phthalic anhydride	37,563,840	21,931,783	4,467,466	.20
Resins derived from tar acids:				
Cresols or cresylic acid	5,284,895	3,882,988	561,432	.14
Phenol:				
For molding	13,487,681	12,787,051	2,189,600	.17
For casting	4,807,671	4,651,991	1,896,425	.41
Other	17,658,391	17,484,415	2,939,971	.17
Xylenols	329,927			
Xylenols and cresols	2,396,273			
(B) Non-coal-tar: Total	23,435,408	17,064,685	7,061,436	.41
Urea	8,249,900	7,467,782	3,312,678	.44
Total for resins reported[1] 1938	130,358,652	101,828,188	22,871,974	.22
Total for 1937	162,104,713	127,175,452	25,845,164	.20
Total for 1936	141,945,676	100,052,566	20,243,882	.20

1. See note 2 of table 1.

CELLULOSE PLASTIC PRODUCTS

These monthly statistics on production and consumption in reporting company plants of cellulose plastic products (sheets, rods, and tubes) and production of cellulose acetate molding compositions were released by Director William L. Austin, Bureau of the Census, Department of Commerce. The data for sheets, rods, and tubes were compiled from the reports of 10 manufacturers for the months of July to December, and 11 manufacturers for previous months of 1938, and 10 manufacturers for previous years. The data for cellulose acetate molding compositions were compiled from reports of 6 manufacturers. The data represent practically the entire industry.[3]

	Cellulose Nitrate					Cellulose Acetate			
Year and Month	Production of Sheets	Production of Rods	Production of Tubes	Sheets, Rods and Tubes Consumed in Reporting Company Plants[1]	Total Production	Production of Sheets, Rods and Tubes	Sheets, Rods, and Tubes Consumed in Reporting Company Plants[1]	Production of Molding Compositions	Total Production
1938	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
January	432,377	165,498	48,499	157,914	646,374	344,539	8,334	369,387	713,926
February	444,871	185,607	44,372	172,253	674,850	337,938	5,409	506,001	843,939
March	481,134	214,784	57,994	204,963	753,912	168,073	7,498	494,926	662,999
April	453,596	199,119	37,989	172,571	690,704	249,185	5,017	479,380	728,565
May	415,981	212,167	40,096	185,568	668,244	257,722	8,869	454,069	711,791
June	429,439	145,197	37,011	233,954	611,647	288,385	6,488	465,348	753,733
July	457,492	142,715	33,371	157,651	633,578	658,250	5,231	384,955	1,043,205
August	725,363	198,860	52,283	281,853	976,506	546,422	6,557	547,569	1,093,991
September	691,688	207,256	74,937	296,208	973,881	592,079	8,315	859,994	1,452,073
October	767,599	203,996	79,496	316,069	1,051,091	944,557	9,611	1,044,076	1,988,633
November	733,450	174,270	70,001	228,006	1,017,721	1,331,717	14,092	1,030,685	2,362,402
December	543,797	187,926	57,695	246,403	789,418	1,111,639	7,162	757,901	1,869,540
Total 1938	6,616,787	2,237,395	633,744	2,653,413	9,487,926	6,830,605	92,583	7,394,291	14,224,797
Total 1937	13,582,778	3,157,525	982,006	3,436,459	17,722,309	13,235,062	124,900	(2)	(2)
Total 1936	13,220,020	2,785,861	928,969	3,324,952	16,934,850	13,036,497	229,047	(2)	(2)

[1] Included in production figures. [2] Molding compositions not called for on schedule for 1936 and 1937.

[3] Ed. Note: Taking 80¢ per lb. as an estimated unit value for cellulose plastics, their total production in 1938 may be valued at $19,000,000.

THE CLASSIFICATION AND CHEMICAL GENETICS OF ORGANIC PLASTICS

by GORDON M. KLINE

This is the second installment of a series of articles, originally presented as part of a symposium on "Plastics in the Electrochemical Industry" at the Rochester meeting of the Electrochemical Society. Publication is approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce. Concluding installment will appear in the August issue.

Synthetic Lastics

The close similarity of the synthetic lastics to the synthetic resins in the chemical structure of their macromolecules, in the raw materials required for their synthesis, and in the processes involved in their preparation makes it desirable to insert the discussion of these plastics immediately after the description of the synthetic resins. The synthetic elastic polymers have been introduced on the market in this country only within the past decade, and they have not yet approached the tonnage production of the synthetic resinous polymers of lesser extensibility and retractivity. However, it is becoming quite evident that some of these synthetic lastics fill a definite need in industry for a material with many rubber-like properties but superior to rubber in resistance to oils, gasoline, various solvents, ozone, atmospheric oxygen, and heat. It is anticipated that the next decade will see just as remarkable an extension of types and applications of these synthetic lastics as took place in the second decade of synthetic resin production between 1920 and 1930.

It is impossible to define the synthetic lastic group of materials in terms of a single chemical structure. Although the polymers of butadiene and its simpler homologs (isoprene, the monomeric unit of rubber, is methyl butadiene) are all characterized by extensibility and retractivity, nevertheless other chemical compounds quite dissimilar to these also yield polymers having the same attributes. Indeed, it is only by the insertion into the synthetic molecule of some element or radical totally unlike anything in the rubber molecule that the superior resistance to oils, ozone, and the like may be obtained. The present commercial synthetic lastics will be discussed here in three groups, namely, (1) the derivatives of butadiene, (2) organic polysulfides, and (3) miscellaneous lastics.

1. *Lastics from Butadiene and Its Derivatives.* In 1910 Mathews and Harries independently and simultaneously discovered that metallic sodium catalyzes the polymerization of isoprene to a rubber-like material. This same catalyst is now employed abroad for the polymerization of butadienes. The name "Buna" for these products is derived from *bu*tadiene and *na*trium (German for sodium). The dienes may also be polymerized while emulsified in water, which method is said to be, in general speedier and to yield a product which is more conveniently handled than the sticky or lumpy masses resulting from polymerization in the unemulsified form. The incorporation of other chemical compounds with the butadienes to produce a copolymer is also more readily accomplished by the emulsion method. The catalysts which are employed for the emulsion polymerization of dienes are usually oxidizing agents, for example, urea peroxides, sodium perborate, and inorganic peroxides.

Butadiene may be produced from three different raw materials, namely, calcium carbide, petroleum, and ethyl alcohol, the choice depending on the supplies available in the country concerned. Acetylene is formed by the reaction of calcium carbide and water, and is converted into acetaldehyde by passage through a dilute acid solution containing a mercury catalyst. The acetaldehyde is polymerized to aldol,

$$CH_3—CHOH—CH_2—CHO,$$

which is hydrogenated to butylene glycol,

$$CH_3—CHOH—CH_2—CH_2OH,$$

which in turn is dehydrated to yield butadiene,

$$CH_2{=}CH—CH{=}CH_2$$

Cracking of petroleum yields butadiene direct, although considerable improvement in the yield remains to be attained before this source will become a practical one. The present process involves the production of secondary butyl alcohol from cracked petroleum fractions. This is dehydrated to yield butylene,

$$CH_3—CH{=}CH—CH_3,$$

which by bromination and dehydrohalogenation produces butadiene. Dehydration of ethyl alcohol under special conditions yields butylene, which is converted to butadiene as described. The properties of the material obtained by polymerization of butadiene alone are reported to be inferior for certain purposes to those of rubber, but the incorporation of other reactive ingredients such as acrylic nitrile in the butadiene emulsion prior to polymerization results in reaction products which are superior to natural rubber in resistance to swelling by solvents and to atmospheric aging.

The butadiene derivative which has been actively promoted in this country is chloro- (*Please turn to page 72*)

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Plastics Digest

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them

General

MODERN APPLICATIONS OF LUMINESCENT SUBSTANCES. L. Levy and D. W. West. Chem. and Ind. (London) *58*, 457–62 (May 13, 1939). A comprehensive review. Zinc sulfide of intense phosphorescence is produced by final heating in the presence of an oxidizing agent. Small traces of impurities, such as iron and nickel, destroy the phosphorescence. These phosphors can be incorporated in molding powders prepared from transparent resins, thus yielding phosphorescent moldings.

PLASTICS AND ARCHITECTURE. R. Cottrell-Butler. Trans. Inst. Plastics Ind. (London) *8*, 38–47, 68 (Jan. 1939). There is a need for information on the long-period durability of plastics so that architects can specify the use of these materials without risk of failure. Plastics are fundamentally in line with the requirements of contemporary building economics relative to prefabrication and mass production.

RESEARCH EMPLOYS PLASTICS. Plastics *3*, 139–41 (May 1939). The use of cellulose nitrate plastic in the construction of model dams at the Hydraulic Research Laboratory of the Carnegie Institute of Technology is described. The cost of models is slight in comparison with that of the actual structures and the use of a transparent plastic facilitates observation of the flow of the water during tests.

WIRELESS TELEGRAPH BOARD SPECIFICATION K.109 FOR LOADED EBONITE. Brit. Plastics *10*, 678–80 (May 1939). Discussion of the requirements and test methods in this specification which is available from H. M. Stationery Office, York House, Kingsway, London, England, for 6d.

Materials and Manufacture

CORK-RUBBER MATERIALS. R. M. Hill. Product Eng. *10*, 239–41 (June 1939). "Corprenes" when placed under compression behave in a manner which is determined by the proportions of rubber and cork in the mixture, the size of the cork particles, and the type of rubber or synthetic lastic used. These products are employed for gaskets, packings, seals, vibration absorption units, and feed rolls.

NEW CAST RESIN FOR APPARATUS CONSTRUCTION. E. Dreher. Kunststoffe *29*, 137–40 (May 1939). A phenolic resin prepared by a special condensation process is reported to be free from shrinkage and resistant to water vapor and various chemical reagents. Information is given regarding the properties, fabrication, and uses of this resin which is marketed under the trade name "Dekorit F."

RUBBER DERIVATIVES AND ELASTIC POLYMERS. J. Delorme. Rev. Gen. Mat. Plastiques *15*, 35–9, 73–7, 110–3, 141–3 (1939).—A review of resins derived from rubber and of synthetic lastics. The vinyl derivatives are indicated to be the most promising sources of elastic products other than those compounds which possess a butadiene nucleus.

FORMALDEHYDE CONDENSATION WITH PHENOL AND ITS HOMOLOGS. IV. MECHANISM OF REACTION. N. J. L. Megson. J. Soc. Chem. Ind. *58*, 131–9 (Apr. 1939). Dihydroxydiarylmethane derivatives are intermediate compounds in phenol-formaldehyde resin formation under acid conditions, their yield decreasing with time of condensation while that of the resin increases. Different reaction mechanisms are postulated for trifunctional phenol and *m*-cresol compared with bifunctional *o*- and *p*-cresols to account for observed yields. For long time of condensation, the rate of resin formation is practically independent of phenolic concentration. The type of acid catalyst used has a considerable affect on the yields of the intermediates. Discussion in Chemistry and Industry *58*, 99–100 (Feb. 4, 1939).

Molding and Fabricating

PLASTIC MOLDINGS OR METAL DIE CASTINGS? E. E. Halls. Plastics *3*, 160–2 (May 1939). Mold wear in plastic molding occurs from abrasion as contrasted with erosion and actual dissolution of the metal mold in die casting. The outlay for dies is higher for metal casting and the greater hazards necessitate additional safeguards for the workman. Machining operations are easier with metal castings than with molded phenolics and the trimmings and rejects can be re-used. The plastic comes from the mold with a satisfactory finish and simply needs buffing and polishing, whereas protective or decorative finishes of enamel, electroplate, or plastic are indispensable on the metal casting.

MAKING INEXPENSIVE DIES. J. F. Rieley. Steel *104*, 46–7 (Apr. 17, 1939). A process is described for making dies for metal casting and plastic molding by electroforming a copper alloy or iron shell over a model and backing it up with bronze, brass, or iron. Electrolytic iron may be case-hardened, is said to be cheap to produce and to require no further treatment of surface, such as chromium plating.

Applications

RENDERING ADHESIVE SURFACES INSENSITIVE TO HIGH ATMOSPHERIC HUMIDITIES. D. W. Glover and E. A. Taylor. J. Soc. Chem. Ind. *58*, 149–52 (Apr. 1939). The application of a film of cellulose acetate of about 0.00001 inch thickness to the adhesive surface produced a large decrease in the sensitivity of stamp rolls used in postage selling machines to humid atmospheres and hence reduced the tendency of these machines to jam. The normal adhesiveness of the stamps was not affected.

PLASTICS IN GERMAN AUTOMOBILES. W. Ostwald. Kunststoffe *29*, 140–2 (May 1939). Illustrated account of various molded parts in German cars.

TEXTILE INDUSTRY NEEDS PLASTICS. Plastics *3*, 153–8 (May 1939). The contributions of plastics to the textile industry include synthetic fibers, such as viscose, cellulose acetate, Lanital, and nylon, water-soluble resins for crease-proofing fabrics, and molding and laminated materials for the manufacture of bobbins, picking sticks, bearings, gear wheels, sliver guides, temple rollers, tenter frames, spinning pots, and the like. Various developments along these lines are reviewed.

COMPOSITE WOOD AND PLASTIC PROPELLER BLADES. F. E. Weick. Soc. Automotive Eng. J. *44*, 252–8 (June 1939). The blade of the propeller consists of a main core of laminated light wood which merges into a root of resin-impregnated and compressed hard wood, which in turn is threaded and screwed into a steel sleeve. The blade portion is protected by impregnation of the surface with cellulose acetate. Advantages of these "Schwarz" propellers are light weight (aluminum blades are 50% heavier), vibrational damping qualities, relative freedom from fatigue difficulties, and ease and low cost of making experimental designs. No failure of these propellers in service operation has been recorded during 8 years of manufacture and no case of ice forming on them has been reported.

FREEDMAN - BURNHAM PROPELLER. G. L. Freedman. Aero Digest *34*, 73–4, 77–8 (June 1939). A report of the development and production of a laminated wood propeller which has a shank impregnated with a thermosetting resin.

Testing

INDENTATION HARDNESS OF SYNTHETIC RESINS. S. Erk and W. Holzmüller. Kunststoffe *29*, 129–33 (May 1939). Measurement of the depth of penetration of the indenting tool is recommended rather than measurement of the surface area of the impression inasmuch as the latter is subject to change because of elastic recovery after the indenting tool is removed. Photographs of indentations in metals and plastics are included.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

POLYAMIDE FIBERS. W. H. Carothers; J. B. Miles, Jr.; W. W. Heckert; J. B. Miles, Jr. (to E. I. du Pont de Nemours and Co.). U. S. 2,157,116; 2,157,117; 2,157,118 and 2,157,119, May 9. Knitted hosiery, made from synthetic polyamide fibers; a steam treatment for improving the properties of polyamide fiber; treating polyamide fibers, bristles, films or fabrics with a setting agent in presence of a water-soluble sulphite; and forming smooth, wrinkle-free fabrics from synthetic polyamide yarns.

MODIFIED PHENOL RESIN. M. T. Harvey (Harvel Corp.). U. S. 2,157,126, May 9. Effecting a phenol-aldehyde resin condensation in presence of cashew nut shell liquid.

PLASTICIZER. G. W. Seymour (to Celanese Corp. of America). U. S. 2,157,190, May 9. Plasticizing cellulose acetate with 2–10% of a product made by condensing oxidized castor oil with formaldehyde.

MOISTUREPROOF PAPER. G. A. Moore (to Humoco Corp.). U. S. 2,157,212, May 9. Coating paper with a nitrocellulose lacquer, casting a wax film on the lacquer, and casting another coat of nitrocellulose over the wax.

CELLULOSIC COATING. J. R. Haines (to Detroit Macoid Corp.). U. S. 2,157,334, May 9. A cellulose ester lacquer capable of air-drying to a coherent, imperforate film 0.005 to 0.0032 inch thick.

PHOTOGRAPHIC FILM BASE. J. G. Davidson (to Carbide and Carbon Chemicals Corp.). U. S. 2,157,384, May 9. A nonexplosive, slow-burning, tough, clear film base with high resistance to aging is made of a partially acetalized polyvinyl alcohol resin.

PECTOPHENOL RESIN. Richard Holzcker. U. S. 2,157,488, May 9. Forming a resin by condensing phenol with pectous compounds extracted from vegetable wastes.

CELLULOSE ACETATE PLASTIC. M. R. Ximenez (to Johns-Manville Corp.). U. S. 2,157,645, May 9. Use of diatomaceous earth as filler in cellulose acetate molding compositions.

PLASTICIZER. M. Hagedorn (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,157,697, May 9. Plasticizing polyvinyl chloride resin with benzoates of long chain alcohols derived from coconut oil.

VINYL RESIN. S. L. Brous (to B. F. Goodrich Co.). U. S. 2,157,997, May 9. Making a polyvinyl chloride resin less soluble and less thermoplastic by heating it with a salt or oxide of iron, zinc, aluminum, tin, copper, nickel, cobalt or the like.

LAMP BASE. C. W. Haller (to Hygrade Sylvania Corp.). U. S. 2,158,044, May 9. Molding heat-hardenable insulation to the inside of metal shells for lamp bases.

RESIN FINISH. A. K. Doolittle (to Carbide and Carbon Chemical Corp.). U. S. 2,158,111, May 16. Coating iron, tinplate or zinc with a vinyl chloride: vinyl acetate resin over an undercoater of partially acetalized polyvinyl alcohol resin.

PHOTOGRAPHIC FILM. E. L. Baxter (to Eastman Kodak Co.). U. S. 2,158,173, May 16. Paper backing for films is coated with a mixed cellulose ester and a polyvinyl ester in such proportions as to give a moistureproof, nonfogging, nonmottling film.

FIREPROOF CABLE. J. G. Ford and C. F. Hill (to Westinghouse Electric and Mfg. Co.). U. S. 2,158,281, May 16. A plastic dielectric for flameproof cable insulation contains chlorinated naphthalene, chlorinated diphenyl, polystyrene, a rubber derivative and tricresyl phosphate.

BRITTLE RESIN. N. D. Hanson and E. Kritzmacher (to Bakelite Corp.). U. S. 2,158,366, May 16. Effecting a phenol-formaldehyde resin condensation in presence of rosin and ammonia to form a resin which is brittle when cold.

CREASEPROOF FABRIC. H. Corteen, R. P. Foulds and F. C. Wood (to Tootal Broadhurst Lee Co., Ltd.). U. S. 2,158,494, May 16. Treating a fabric with a resin, which is insolubilized within the fiber, and then swelling with a mercerizing agent.

RUBBER DERIVATIVE. I. Williams (to E. I. du Pont de Nemours and Co.). U. S. 2,158,530, May 16. Making a thermoplastic rubber derivative by heating rubber with phenol and a catalyst such as boron trifluoride.

MOISTUREPROOF FOIL. Wm. H. Charch and Dorothy E. Bateman (to E. I. du Pont de Nemours and Co.). U. S. 2,159,007, May 23. Moistureproofing a transparent wrapping foil with a transparent moistureproof film over an anchoring coat of phenol-aldehyde or urea-aldehyde resin.

DIAL. Edw. K. Madan. U. S. 2,159,095, May 23. A dial for reading rule scales or the like is made of a polymethacrylate resin.

VINYLACETAL RESINS. C. R. Fordyce and M. Salo (to Eastman Kodak Co.). U. S. 2,159,263, May 23. Stabilizing polyvinylacetal resins by treatment with nitrous acid.

CELLULOSE DERIVATIVE PLASTIC. T. A. Kauppi (to Dow Chemical Co.). U. S. 2,159,384, May 23. Blending nitrocellulose with ethylcellulose and a compatible resin, with the aid of a plasticizer.

PHENOLIC RESIN. F. J. Wallace (to Robeson Process Co.). U. S. 2,159,411, May 23. Making a resinous product from a phenol-aldehyde resin and the solids of sulphite waste liquor.

SAFETY GLASS. E. H. Haux and E. L. Fix (to Pittsburgh Plate Glass Co.). U. S. 2,159,630, May 23. Applying synthetic resin interlayers to glass with the aid of a plasticizer, a solvent and water.

LAUNDRY-FAST SIZING. K. Zwicky and F. Brunner (to Aktiengesellschaft Cilander). U. S. 2,159,875, May 23. Sizing textiles by forming an acetone-formaldehyde resin within the fabric.

SOFTENING NITROCELLULOSE. J. F. T. Berliner (to E. I. du Pont de Nemours and Co.). U. S. 2,159,926, May 23. Softening nitrocellulose plastic sheeting by treatment with methanol containing a ketone, higher than acetone but with not more than 9 carbon atoms.

BRAKE LINING. V. H. Sanders (to Stackpole Carbon Co.). U. S. 2,159,935, May 23. A hard, heat-resisting brake lining is made of a powdered refractory, asbestos and a heat-hardenable resinous binder.

MOLDING HORN. S. Bakonyi (to O. Kraus). U. S. 2,159,981, May 30. Making a molding powder from natural horn by impregnating hoof meal with urea and an aldehyde, drying, grinding and hardening by heat.

(Please turn to next page)

POROUS POLYACRYLATES. W. Bauer and H. Lauth (to Röhm and Haas Co.). U. S. 2,160,054, May 30. Making bulky porous polymers of acrylic or methacrylic acid or their nitriles or esters by polymerizing in paraffin oil, then extracting the oil.

CAN COATINGS. A. K. Doolittle (to Carbide and Carbon Chemicals Corp.). U. S. 2,160,061, May 30. A vinyl chloride-vinyl acetate interpolymer, stabilized with a phosphate or sulphide, is used in coatings for tinplate or for iron.

PLASTICIZER. C. Ellis (to Standard Oil Development Co.). U. S. 2,160,133, May 30. Plasticizing soluble cellulose ethers and esters with nitrated polymers of hexene or of higher olefins from petroleum.

SULPHONAMIDE RESIN. H. A. Bruson and J. W. Eastes (to Resinous Products and Chemical Co.). U. S. 2,160,196, May 30. Making resins by condensing aliphatic polysulphonamides with formaldehyde.

INSULATED WIRE. W. A. Gibbons (to U. S. Rubber Co.). U. S. 2,160,204, May 30. Rubber, with sufficient sulphur for a hard rubber cure, is compounded with an elastic polymer of isobutylene for use as insulation on wire.

OILPROOF RESIN. M. M. Safford (to General Electric Co.). U. S. 2,160,230, May 30. Milling a cured alkyd resin with plastic chloroprene polymers to make an oil-resisting composition.

HOSE LINING. E. Schnabel (to Resistoflex Corp.). U. S. 2,160,371, May 30. Lining fabric hose or tubing with a flexible polyvinyl alcohol resin by sliding a tube of the resin into the hose, expanding under gas pressure, and curing by immersing the hose in hot water.

GASOLINEPROOF LININGS. H. Stärk (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,160,372, May 30. Lining gasoline hose, pipes or tanks with a polyvinyl formate resin.

ALCOHOL-SOLUBLE RESINS. Wm. H. Carmody (to Neville Co.). U. S. 2,160,537, May 30. Polymerizing the resin-forming components of crude solvent naphtha in presence of phenol and an activated clay.

BOX TOES. J. C. Guhman (to Wright-Guhman Co.). U. S. 2,160,590, May 30. Cementing celluloid shoe stiffeners in place by means of an intermediate layer, impervious to solvents for celluloid, an adhesive which adheres to leather, and an inmost layer of material which is pervious to the softened celluloid.

VINYLIDENE CHLORIDE PLASTICS. J. H. Reilly and R. M. Wiley; R. M. Wiley; J. H. Reilly and C. R. Russell; J. H. Reilly; J. H. Reilly and R. M. Wiley; R. C. Reinhardt; E. C. Britton, C. W. Davis and F. L. Taylor; E. C. Britton and C. W. Davis; G. H. Coleman and J. W. Zemba; R. M. Wiley; E. C. Britton and F. L. Taylor; R. C. Reinhardt; R. M. Wiley, F. N. Alquist and H. R. Slagh (all to Dow Chemical Co.). U. S. 2,160,903-4; 2,160,931-2-3-4-5; 2,160,936; 2,160,937; 2,160,938; 2,160,939; 2,160,940-1-2; 2,160,943; 2,160,944; 2,160,945; 2,160,946; 2,160,947; 2,160,948, June 6. Polymerizing vinylidene chloride to a heat-resisting, chemically inert resin, and plasticizing it with chlorinated diphenyl or like polychloro compounds; interpolymerizing vinylidene chloride with vinyl esters or styrene, and catalyzing vinylidene halide polymerizations with tetraethyl lead, organic peroxides, metal carbonyls, polyhalophenols or the like; polymerization in a solvent; polymerization in a nonsolvent for the polymer, to form a gel; interpolymerization in a water-miscible inert liquid; mixed polymerization catalysts, one component being spongy copper; interpolymerization with unsaturated esters of di- or monocarboxylic acids or of inorganic acids; interpolymerization with allyl ethers; stabilizing monomeric vinylidene chloride against polymerization by adding alkyl- or arylamines; interpolymerizing with acrylate esters; interpolymerizing with allyl (or methallyl) mono- or dichloroacetates; interpolymerizing with a monochloropropene; plasticizing and heat-stabilizing polyvinylidene chloride with alkyloxy or aryloxy derivatives of propylene oxide.

Equipment

TWO NEW MODELS HAVE BEEN ADDED TO THE LINE OF 9-IN. Workshop Precision Lathes manufactured by the South Bend Lathe Works. Both Model A, quick change gear type, and Model B, standard change gear type, are equipped with an automatic apron with friction clutch drive for operating the automatic power cross feeds and power longitudinal feeds of the lathe carriage. (Illustrated above.)

A new 14½-in. swing lathe, with especially designed attachments which adapt it for duplicate manufacturing operations, for fine tool and gage work, etc., is manufactured in motor drive and countershaft drive, in several bed lengths, in quick change and standard change gear types.

DESIGNED TO MINIMIZE DRAFTING FATIGUE, THE NEW Excello Drafting Machine, announced by the Eugene Dietzgen Co., accomplishes this by "free floating" action. This feature is obtained by the use of lightweight alloys, roller bearings and precision construction. "Gravity control," eliminating friction brakes and overhanging weights, prevents drag. Protractor head places the control of angles directly under the thumb without tiresome wrist-twisting.

CONTAINING ALL USUAL DECIMAL EQUIVALENTS FROM 1/64 to 63/64, a new easily transferable 8 in. by 1¾ in. decal is announced by the Frederick Post Co. Sized to fit the T-square, the chart will eliminate the usual squinting at distant wall charts. It is free to all in the architectural, engineering, designing, or drafting professions.

FOR FIRMS AND INSTITUTIONS WITH LIMITED FUNDS TO spend on testing equipment, Tinius Olsen Testing Machine Co. announces a moderately priced, compact L-Type hydraulic testing machine. Its capacity is 20,000 to 60,000 lbs., yet overall height is but 63½ in.; it occupies only 10 sq. ft., and weighs 2000 lbs. Advanced features of design and construction include a moving piston for testing strain, direct-connected gear pump with a constant operating speed, pilot controlled testing speeds. (Illustrated above.)

New Seth Thomas "PROCTOR" clock, with electric or 8-day movement. One piece case of Plaskon—in light ivory, pastel green or light red.

Publications

Write for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices.

Casein and Its Industrial Applications

by E. Sutermeister and F. L. Browne

American Chem. Soc. Monograph No. 30, Second Edition
Reinhold Publishing Corp., 330 W. 42nd St., New York, 1939
Price $6.50 **433 pages**

Last year the first edition of this book was still the outstanding source of information on casein in all its ramifications. This revised and considerably enlarged edition is, therefore, unquestionably tops in its field. The introduction to the book calls attention to three spectacular technological achievements during the interim between the original publication of the book in 1927 and its present revision. "Casein plastic, through improvements in processing, has become firmly established in the button business. Casein paste paint, an entirely new product, has appeared and won an important place in the paint industry, while the older powder paints have also been improved and grown in volume. A new synthetic textile fiber resembling wool has been invented and has found commercial application in Europe and Japan, though its place in American economy remains to be shown."

The book is subdivided into 13 chapters dealing with the following aspects of casein chemistry and applications: Casein in milk and its isolation; Organic chemistry; Physical chemistry; Manufacture; Testing and analysis; Storage; Plastics; Glues; Paper making; Paints; Leather; Alimentary and medicinal uses; Miscellaneous uses and statistics. Extensive subject and author indexes provide ready access to specific details in the wealth of information included.

The chapter on "Casein Plastics" has again been written by Dr. George H. Brother and covers very thoroughly the problems involved in the manufacture and utilization of this type of plastic in the United States. An appendix to this chapter presents a brief discussion of the development of synthetic fiber from casein. It is of interest to note that of the 1370 references listed in the book, more than a third of them are to be found in the chapter on plastics. G.M.K.

TO CELEBRATE TEN YEARS OF DESIGNING FOR INDUSTRY, Henry Dreyfuss has published a delightful and important book illustrating the progress in product design made during that period. From alarm clock to Perisphere, many of the most interesting problems worked out by Mr. Dreyfuss are shown with factual descriptions. There is a foreword by Gilbert Seldes which outlines the purpose of design and points out that in 1929 "two suspicions began to arise: first, that objects made by machine processes didn't have to be ugly and unhandy; and second, that making them more agreeable to see and to use might be a help in the sales department."

It is unfortunate, we feel, that this book is published in a limited edition because its broad distribution among consumers and industrialists couldn't help but impress them with the advantages of intelligent design, and prove to the skeptical that much sound progress has been made during the past ten years.

MARKETING RESEARCH ACTIVITIES OF MANUFACTURERS, A survey prepared by the U. S. Bureau of Foreign and Domestic Commerce has been released and may be obtained for 25 cents each upon application to the Bureau, Washington, D. C., or from any District Office. This study, made in cooperation with the American Marketing Association, presents detailed information regarding the marketing research carried on by manufacturers under the four categories of policy, product, market, methods and means research, and the organizations set up for such work. One section gives a number of concrete illustrations of benefits derived from the application of such research. The report is a splendid guide for manufacturers of industrial or consumer goods who are engaged in or contemplating such research.

Zur Chemie Der Kunststoffe

by Emil Dreher

J. F. Lehmanns Verlag, München, 1939
Price (foreign): 4.80 RM **107 pages**

This collected series of papers were originally published by this well known author in the journals "Kunststoffe" and "Farbe und Lack." The subjects of the five papers are (1) the Estimation of Molecular Weights of High-Molecular Organic Compounds by Viscosity Measurement, (2) the Relation of Synthetic High-Molecular Compounds to Drying Oils, (3) Fundamentals of Polymerization Processes, (4) Fundamentals of Polycondensation Processes, and (5) Solubility of High-Molecular Film-Forming Materials. Numerous summaries of information in tabular form and extensive references to the literature are especially valuable features of this book. G.M.K.

Kunststoff-Taschenbuch, 4th Edition

by Dr. F. Pabst

Verlag Physik F.u.L. Pabst, Berlin-Dahlem, 1939
Price (foreign): 1.80 RM **284 pages**

This is a pocket-size reference book, presenting information on many phases of plastics of interest to both technical and sales personnel. It includes descriptions of the preparation and applications of the various commercial plastics, quantitative data for many of their physical properties, standard classification and testing methods, a brief discussion of the chemistry and chemical analysis of plastics, a list of trade names international in scope, and an abridged dictionary of words commonly encountered in plastics literature, giving English, French, German, Italian, and Spanish equivalents in one alphabet. G.M.K.

GENERAL PLASTICS, INC., NORTH TONAWANDA, N. Y. HAS recently issued a bulletin, designed for industrialists interested in plastics, on Durez molding materials and other products. Along with illustrated lists of applications and description of the material's properties, the folder contains valuable suggestions for designing molded plastics and for part design, with instructive diagrams.

THE LATEST EDITION OF *CHEMICALS BY GLYCO* ISSUED BY Glyco Products Co., Inc., 148 Lafayette St., N. Y., describes the synthetic resins, waxes, and plasticizers, the fatty acid esters of glycerin and glycols, emulsifying agents, manufactured by them. Also suggested formulas and other useful information for the manufacture of numerous types of products are contained in the catalog.

A NEW 12-PAGE BOOKLET WHICH CONTAINS A DESCRIPTION, some ideas of the present uses of, and the application procedure for various Amercoat cold-applied corrosive-resistant plastic coatings has been issued by Amercoat Sales Agency, 5905 Pacific Blvd., Huntington Park, Calif. These coatings, described in MODERN PLASTICS, December 1938, are basically synthetic organic plastics that have been modified to form various types of corrosion-resistant coatings which protect surfaces from acid, alkali, and other types of corrosive action of the most severe sort.

A 4-PAGE ILLUSTRATED FOLDER LISTS WITH SPECIFICATIONS plastic stock molded pulls, knobs, and handles available in a wide range of colors from Imperial Molded Products Corp., 2925 W. Harrison St., Chicago, Ill.

"NEWS PATHS TO PROFITS," DESIGNED AS A BUSINESSMAN'S primer to modern plastic materials is the title of a recent 16-page booklet of the Bakelite Corp., 247 Park Ave., New York. Various types of plastics and their possibilities for increasing sales and profits are briefly described. Non-technical language explains properties and applications of the company's materials. Profuse color illustrations indicate the beautiful effects obtainable with plastic materials and show how they revolutionize product design to increase sales and cut production costs. Copies are available to business executives upon request.

News

NEWEST OF THE NEW YORK PLASTICS SHOWROOMS IS THAT of Monsanto Chemical Co. at 30 Rockefeller Plaza. Monsanto plastics were used extensively in construction and decoration of the room. Particularly interesting is the paneling, made of large sheets of .090 in. cellulose acetate fitted into aluminum channels. Shown in this picture is the curved end of the room opposite the entrance. In this section, the cellulose acetate is transparent, polished on the outer surface, frosted on the back. Soft illumination is diffused through this wall by color floodlight concealed in the rear. Indirect light housings in the ceiling are of cast phenolic resin. Showcase windows are of safety plate glass with a Monsanto Butvar polyvinyl acetal interlayer. This room houses one of New York's most comprehensive plastics displays, as products of all the Monsanto plastics are represented, including: cellulose nitrate, cellulose acetate, cast phenolic resin, resinox phenolic molding compounds, and Butvar and Formvar polyvinyl acetal resins. C. F. Reeves, New York sales manager, is in charge.

THE FALL MEETING OF THE SOCIETY OF THE PLASTICS Industry will be held at the Westchester Country Club, Rye, N. Y., on October 1st, 2nd and 3rd. The directors announce that there will be an important business meeting at 9:00 A.M. on Monday, October 2nd, at which all those interested in the progress and development of the Society should be present. Further details of this meeting will be mailed to the membership before this date.

The headquarters of the meeting will be the Grill Room and the Sports Lounge in the Sports House and further details of the Fall gathering will be announced in the September issue of this magazine. George K. Scribner, of Boonton Molding Co., is chairman of the Entertainment Committee.

GENERAL ELECTRIC CO. HAS ANNOUNCED ARRANGEMENTS for purchasing equipment and facilities of General Laminated Products, Inc., New York, according to G. H. Shill, manager of G-E's plastics department. Distribution and fabrication of Textolite laminated materials will now be assumed by the G-E plastics plant at Meriden, Conn. General Laminated Products, Inc., of Illinois, however, will continue as fabricator and distributor of the material in the Middle West.

JOSHUA BROWN, FORMERLY WITH REISS ADVERTISING AND Metro Associated Services, has just joined the Alfa Display Co. at 95 Madison Ave., New York, handling production.

GEORGE H. BOEHMER, FOR THIRTY YEARS ASSOCIATED with Celluloid Corp., 10 East 40th St., New York., has retired from position of general sales manager. His position will be filled by Edward W. Ward, now assistant general sales manager.

A COLORING PROCESS DEVELOPED FOR SURFACE DYEING cast resins has been patented by Dipol Process Co., Rochester, N. Y. Comparatively inexpensive, the solution can be handled with little difficulty for dyeing cast phenolic articles by a simple method that will affect the surface and penetrate the body of the material sufficiently to create the desired effect. Any spirit soluble basic dye or any combination of such dyes can be used, and the spent dye solution can be used repeatedly by adding water to make up for evaporation losses and sufficient dye to replace that which has been used.

MOLDED INSULATION CO. HAS RECENTLY MOVED INTO larger quarters at a newly purchased plant at 335 East Price St., Philadelphia, Pa. In addition to conventional equipment, this company operates six fully automatic presses, which it has developed and which are being manufactured and marketed by F. J. Stokes Machine Co.

NATIONAL SEMI-ANNUAL MEETING OF THE AMERICAN Society of Mechanical Engineers, at San Francisco, is announced for the week of July 10. In addition to the complete program of technical sessions, inspection trips, plant visits and social functions, the Golden Gate International Exposition has designated Thursday, July 13, as Engineer's Day, the main feature of which will be an address by ex-President Herbert Hoover, honorary member of the A.S.M.E.

OUR READERS ARE CORDIALLY INVITED TO VISIT THE offices of MODERN PLASTICS whenever they are in the neighborhood (Chanin Building, opposite the Commodore Hotel, near Grand Central Station) to see our Rotating Exhibit of the latest developments and products in the plastics field.

Each month through the courtesy of the various manufacturers, we display many of the items pictured in the "In Review" section and editorial feature pages of the current month. This gives you an opportunity to actually see and handle the items described and pictured in the magazine and gives us an opportunity to discuss with you any particular plastic problems in which you may be interested.

In this way we are enabled to extend our editorial service beyond the printed page and place it on a more helpful, friendly and cordial basis.

CHARLES E. SLAUGHTER, FORMERLY ASSOCIATED WITH Plaskon Co., Inc., is now sales manager of Universal Plastics Corp., New Brunswick, N. J. *(Please turn to next page)*

Airviews of the 2 vast sources of the superior quality DICALITE FILLERS: (top) the Dicalite deposit at Palos Verdes, California, and (lower) the Oromite operations, near Terrebone, Oregon.

The MODERN Fillers for PLASTICS

WITH the use of DICALITE FILLERS in your plastics—molded or cast—you get these distinctive advantages:

Increased strength
Better color qualities
Improved heat and fire resistance
Greater durability
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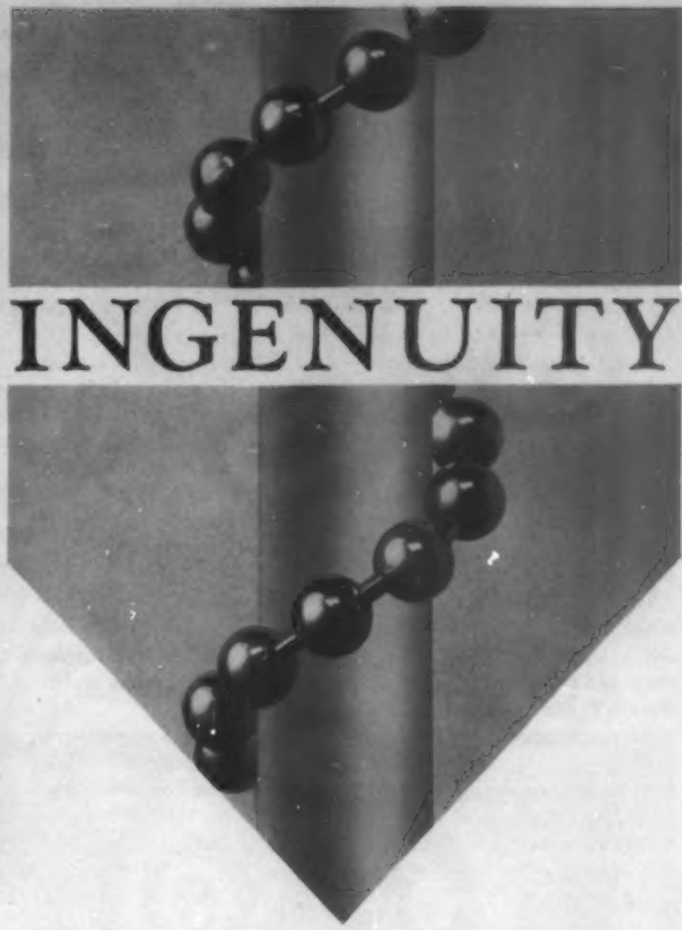

BEAD CHAIN*

Because each bead and connecting link form a perfect swivel BEAD CHAIN* will follow any contour, and is of unusual value for many types of decoration, operation and control. BEAD CHAIN* cannot kink nor tangle. It is made of many metals, including Monel, with couplings and attachments to your requirements, in bead diameter sizes from 3/32" to 3/8".

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ESTABLISHED 1914
Trade Mark Reg. U.S. Pat. Off.

Our 25 years' experience is at the service of designers, engineers and manufacturers for the development of practical assemblies of BEAD CHAIN* for use with their products.

THE BEAD CHAIN MANUFACTURING CO.
60 MT. GROVE ST. BRIDGEPORT, CONN.
* Reg. U. S. Pat. Off.

YOU MAY HAVE READ ABOUT THE NEW YORK WORLD'S Fair and wondered why we haven't written anything about it since its gates were thrown open. There is a good reason and we're not apologizing, but it has been somewhat of a job to find all the good uses of plastics tucked away in hundreds of buildings on a 1216½ acre plot. A lot of peeking and walking had to be done. It has been even more of a job to get good photographs of these plastic installations but we are getting them as you shall see in our August issue.

Meantime, if you want to see plastics being molded on conventional equipment, or want to take a squint at some of the interesting exhibits where plastics are used, just go to the General Electric Building, or Du Pont's, or Ford Motor Co., or Westinghouse, or to the Hall of Industrial Science where Bakelite Corp. and Röhm & Haas Co. exhibit.

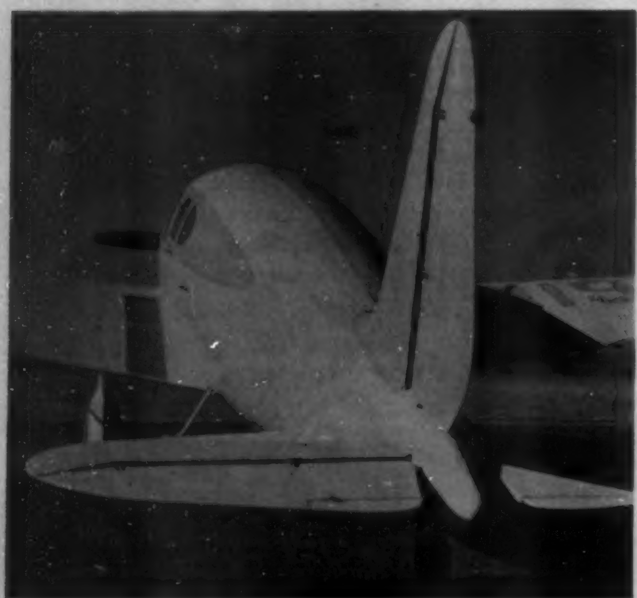
General Electric Co. has two semi-automatic presses in daily operation and their new material, Parkwood-Textolite, is used very nicely in the decoration of the building interior.

Du Pont has some intriguing murals all made of plastics which we shall illustrate next month. They also operate a Reed-Prentice injection press which molds Plastacele before your eyes.

Röhm & Haas exhibits a startling display of Plexiglas designed by Gilbert Rohde, which illustrates some of the more important uses of this material and indicates its workability.

The Ford Motor Co. operates many visual exhibits of automotive production. Among them are a Lester injection press, a hydraulic press, and a laboratory machine making synthetic wool from soybeans. Many plastics are used in this exhibit which was designed by Walter Dorwin Teague.

Bakelite Corp. has the largest exhibit of plastic products and you'll not want to miss this display. Here you will see an HPM injection press molding acetate material and polystyrene as well as a Stokes automatic turning out souvenirs of phenolics. You can also see more examples of molded and laminated plastic products here than anywhere else we know. Practically all types of plastics are well represented.



The Bakelite Exhibit was formerly opened on Tuesday, June 20th, with a galaxy of celebraties from the army, navy and civilian industry in attendance. The Clark Duramold airplane, described and pictured in our March 1939 issue, which has had now more than 300 hours flying service, made a special appearance and was formally dedicated by its creator, Col. V. E. Clark. (Illustrated above.)

This plane, sponsored by Fairchild Engine and Aircraft Corp. and built by Clark Aircraft Corp., in collaboration with the Haskelite Corp. and Bakelite Corp., represents a rapid method of aircraft construction with peculiar properties of light, sturdy construction and smooth exterior surface. The fuselage is laminated in two halves which are afterward sealed together with a plastic bond.

THE BRITISH XYLONITE CO., PIONEER BRITISH PLASTIC manufacturer, has opened a showroom and exhibition gallery called "The Plastics Centre" at 4–7 Chiswell St., London E.C. 1. Examples of plastic products for interiors, finished products in many materials and a "Development Gallery" which suggests new uses and methods for raw materials offer a comprehensive view of the phases and potentialities of plastics. The internal arrangement and architectural effects which make notable use of thermoplastic materials are the work of Walter Landauer of Industrial Design Partnership. Illustrated above is a view from the Development Gallery.

THE RESISTOFLEX CORP. HAS REMOVED ITS DOVER, N. J., plant and executive offices (formerly in New York) to Belleville, N. J., where the first unit of their new manufacturing plant is situated.

HILO VARNISH CORP., 42–60 STEWART AVE., BROOKLYN, N. Y., announces release of Vitra-Carlite clear. Actual tests show a one dip, baked at 250° F. for 1 hour produces a beautiful finish with practically no discoloration of the metal. It offers real possibilities for all kinds of dip work, enameled metal and wood, and on bright metal parts which are subjected to considerable heat inside or out. Wood handle trade now use this over colored enamels to give added lustre, toughness and surface hardness.

TWO SUMMER SESSIONS THIS YEAR, FROM JULY 10TH TO August 18th, have been introduced by School of Design, 247 East Ontario St., Chicago, Ill. One will be held in the school building, the other at "Rumney Farm," Somonauk, Illinois. Regular Fall semester will start Sept. 25, 1939.

WILL FUNSTON, INDUSTRIAL STYLIST, HAS ANNOUNCED the affiliation of his firm with Trinity Associates, Inc., publicity and sales promotion organization. The expanded activities of the two related companies, he reports, will include style analysis and the creation of balanced merchandise lines, primarily in the home furnishing and equipment fields, together with the publicizing and promotion of such products. Both have headquarters at 23 East 31 St., New York.

JULES FRIEDMAN, FORMERLY OF KAPPA BUTTON CO., CASEIN manufacturers, is now associated with Stanley Novelty Corp. with headquarters at 989 6th Ave., New York.

REYNOLDS MOLDED PLASTICS, DIVISION OF REYNOLDS Spring Co., have transferred all production activities to their new plant at Cambridge, Ohio, J. G. Rossiter, sales manager reports. All matters pertaining to sales, engineering, accounting, etc., will be handled as formerly from their general offices in Jackson, Mich.

INCREASING INTEREST IN AN AIR-DRYING OR QUICK-BAKING protective coating, G-E 1201 Glyptal Red, for motor and apparatus protection, especially among mining companies, oil refineries, traction companies and industrials, is reported by the General Electric appliance and merchandise department, Bridgeport, Conn.

THE CHANGING PACE

(*Continued from page 31*)

Automatic side-ram molding machine

Watson-Stillman is starting production on a fully automatic molding machine designed in collaboration with John Lauterbach, whose rotary automatic is well known. I didn't see this press but am including its description obtained from W-S engineers as it was told to me. The machine, standing nearly ten feet high, is designed to handle either preforms or loose molding compound, and loads the cavities with a measured amount of the material. Pieces are molded with a definite time cycle and ejected. Dies are blown out with compressed air and successive molding operations are repeated without any manual operation whatsoever, it is reported.

This machine consists primarily of two hydraulic cylinders, one vertical, and one horizontal; also a feed and ejector mechanism automatically operated and timed to function in proper sequence.

The machines will soon be offered in 25-ton, 50-ton, 100-ton and 150-ton capacities and while they are designed primarily for thermosetting materials, it is reported that thermoplastics may be molded as well.

It is claimed that any type of die may be used—flash, semi-positive, positive, or split; in single or multiple cavity with one or more rows. Split dies are used without special handling and may be mounted in a vertical or horizontal position. Adjustable stripper rods are provided on both vertical and horizontal cylinders. Pressure on cylinders is adjusted independently.

One of the reported features of this machine is the arrangement for mounting dies so they move out of line while the pieces are being ejected The force plugs are raised with the vertical ram which is stopped momentarily at any desired position. The die opens with the return of the horizontal ram and the top die, or plate carrying force plugs, is then moved laterally the required distance so when the pieces are ejected, they drop clear of the stationary half of the die. When using a solid die, the lower half moves clear after the force plugs are raised above the die; then the vertical ram is moved to the end of its upward stroke and the pieces ejected.

The molds are cleaned with compressed air. This is automatically timed and takes place before each subsequent charging operation. Low pressure is applied for a definite time, which is adjustable and may be set for best results. The timing of the gassing and the duration of cure is adjustable also.

The base contains an oil reservoir, cooling coils and a rotary pump of double unit type, with a large capacity low-pressure pump and small capacity high-pressure pump. Both rams are double acting and pistons are packed with metallic rings, according to the release.

Automatic with twin molds

Last month we ran a brief announcement of the Standard automatic molding press distributed by F. J. Stokes Machine Co. but details were lacking. Now we can show a photograph of this press and while I haven't seen it in operation, I understand one of them is doing a good job in regular service in the plant of Bridgeport Moulded Products, Incorporated.

This is reported to be a completely automatic compression molding press for thermosetting plastics using multi-cavity molds, and is designed to give low molding costs for large production runs. It performs all the operations of routine molding including loading the powder into cavities, closing the press, preheating the material, opening the mold for gassing, closing for cure, ejecting the finished molded parts, blowing flash from cavities and forces and repeating the cycle with no manual attention necessary other than feeding the hoppers with molding powder. (*Please turn to next page*)

The Watson-Stillman side ram press (left) is fully automatic with a horizontal opening between plates of 19 in. (25-ton) and 22 in. (50-ton) with a vertical opening of 21 in. and 23 in., respectively. The press is self-contained with pump and oil reservoir in its base. It is capable of turning out complicated molded parts without human attention. For example, the molded dental bar illustrated below

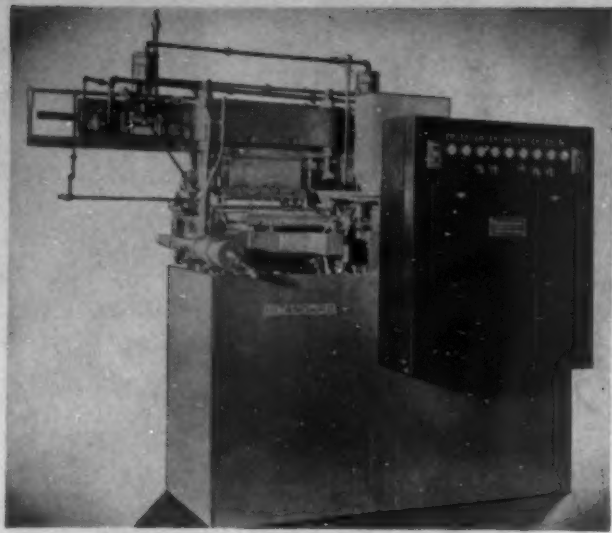
The press is so designed that the ejecting, cleaning and loading of the mold is done outside of the press cycle. Two sets of molds are used in the press. While one mold is under pressure during the cure, the other mold is outside the platens of the press, the upper mold to the left and right of the head of the press alternately and the lower mold moves to the front and back of the press bed alternately. With this construction, the remaining time of the press cycle, outside the curing period, is the time required for the press to open, the molds to shift position and the press to close, all of which requires about 13 seconds with a 6 in. stroke of the ram. Hoppers are arranged on the front and rear of the press and the cavities of each mold are filled alternately from these hoppers by means of an automatic loading board.

In tests made with a 28-cavity mold for attachment plug caps, the press operates continuously on a 55 second cycle which includes 13 seconds for opening and closing the press, 7 seconds for gassing, and the remaining 35 seconds for cure.

The 56 cavities for this test were taken from a mold in a 100-ton press, manually operated. Production increased through a shorter time cycle and the quality of the work was improved with highly uniform dielectric strength and physical properties in the molded parts.

With automatic molding once the time cycle is definitely established it can be repeated automatically and timed to a fraction of a second. There can be no human tendency to shorten the cycle to speed up production, resulting in weakening of these properties through uncured parts. If molding compound is uniform from one drum to another, the finished parts are equally uniform.

The multi cam cycle controller on this press allows the timing of each operation independently of the others. However, the only change necessary to make in going from one mold to another, is in the preheating, breathing and curing periods. The curing time is adjusted separately by a microflex reset timer with a range from 2 seconds to 4 minutes by merely turning a knob attached to a dial indicator.



This is the new Standard self-contained compression molding press for thermosetting materials. It is entirely automatic in operation and there is no idle press time since twin molds are used. While one mold is under pressure during the cure, the other mold is outside the platens of the press, ejecting its parts and taking on a fresh load of molding compound. Separate hoppers are arranged at the front and back of the press which alternately fill the molds by means of automatic loading boards. One of these presses is operating in the plant of Bridgeport Moulded Products, Inc. They are distributed through F. J. Stokes Machine Company

Cartridge filled injection press

The Grotelite Co., pioneers in injection molding in the United States, has worked out an injection process for thermoplastics which is claimed to remove the size limitations current in this type of production.

The Grotelite method approaches the problem from an entirely fresh angle. It resembles the technique of supplying a rapid-fire gun with suitable shells which are produced elsewhere but arrive in ample time to load the gun each time before firing.

Instead of heating the plastic material in the press, this new process heats the material in containers made to fit the press in a manner similar to cartridges. The filled containers are heated in an oven until the proper plasticizing temperature is attained, then are fed automatically (or by hand) to the press which forces the heated contents of the container directly into the mold. This is done either by crushing the container, or by exhausting the container into a pressure chamber if a refillable container is used for the supply of material.

The heating is done slowly and at a temperature which never exceeds the plasticizing temperature, thus avoiding any possibility of scorching the material. Large containers may take hours to heat properly but they are provided in sufficient quantities to feed one press or a battery of presses in constant operation.

By this method, the conventional heating chamber is entirely eliminated from the press. So is the temperature regulating apparatus.

By dispensing with the conventional spreader or "torpedo" and providing thoroughly pre-plasticized material, the movement of the material in the pressure chamber is facilitated through elimination of friction. This makes more pressure available for forcing the material through the runners and gates of the mold, and in addition, permits the use of materials employing less plasticizer and lubricants, according to the release.

When molding acrylic resins, the company says, it is necessary to hold 25,000 lbs. pressure, but if dry material gets in front of the ram, in forcing it through the narrow openings in the torpedo, 40 to 60 percent of the pressure is lost. By this process it is claimed that 22 ounces of acrylic can be injected with a full 25,000 lbs. of pressure on the material in the mold. Therefore, the material flows faster and makes a better weld. With less plasticizer and lubricant, a harder casting results.

"We are using the cartridges on our regular Grotelite machine," says Mr. Grote, "but we can take any injec-

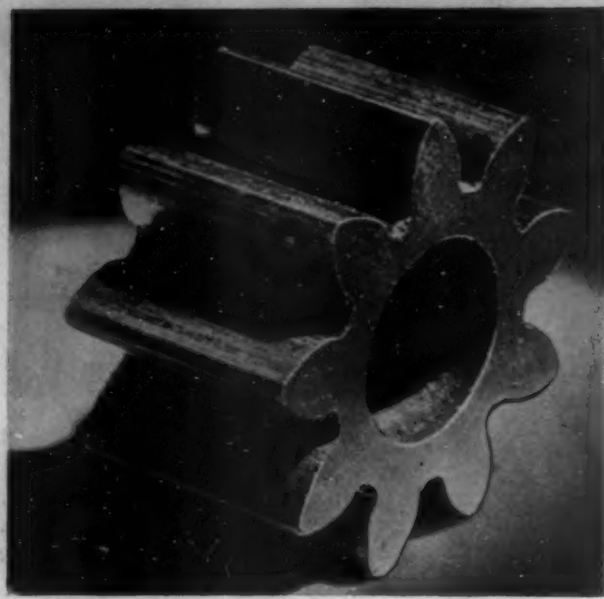
tion press on the market, change the feeding mechanism, and make it adaptable to our cartridge feed method."

Automatic molding of some sort has long been needed in order to bring this Plastics Industry through adolescence into grown-up economical production comparable to mass production in the automotive and other industries which constitute its clientele. This will not mean a lessening of employment within the industry because there still will be plenty of hand operations required in the making and caring for dies, building and maintaining presses, engineering and sales. It will allow additional opportunities for those now engaged in day molding to advance with the industry.

These automatic machines will take much of the guess work out of molding by eliminating human inaccuracies and carelessness and will help workmen turn out better molded parts as the result. By increasing production per press unit and eliminating waste of compounds so that one hundred pounds of molding powder going in at one end of the press will turn out one hundred pounds of perfectly molded parts from the other end, the competitive position of molded plastics will be such that innumerable new jobs and new applications will be found. It looks right now as though this desired condition is about to come to pass. At least four other automatic presses are in development but details are lacking.

Molded metal gears

Not exactly a plastic application but interesting, nevertheless, because the idea was conceived from a conventional molding operation. This, too, is at the Ford plant where sponge iron is molded into gears on a standard preforming press of the double acting type. Gears pop out at the rate of twenty a minute from a single cavity die, perfectly formed, and requiring only heat treatment before they go into service. Eleven machining operations are saved through this procedure and their cost is cut to a mere fraction of its former level. There is a high material cost but labor cost is almost entirely eliminated. Wearing qualities in service equal in every respect the machined gears they have replaced.



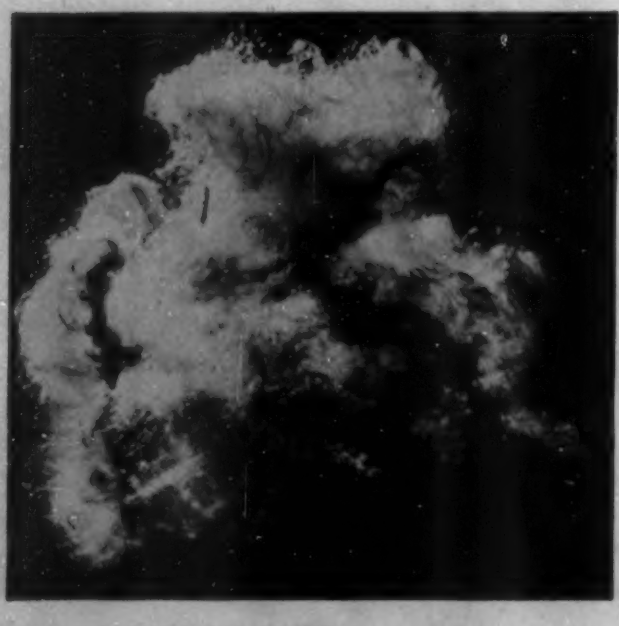
The sponge iron gear shown above, nearly three times actual size, was molded in a standard preforming press by Ford Motor Company

Soybean wool

Soybean at last, may have found its niche in industry. For some years experimentation has been going on to find a practical use for soybean meal after the oil has been extracted for use in varnish. The Ford company, through its Edison Institute, probably has done more in this direction than any other agency. They have successfully combined the material with phenol to make plastics and thousands of tons of the material have been made and molded.

But on a recent visit to the Institute I saw soybean meal being converted to yarn which has enough of the properties of natural wool, it is believed, to make it available as upholstery material. A similar demonstration unit is being operated in the Ford Exhibit at the New York World's Fair.

Soft, fluffy, synthetic wool made from proteins chemically extracted from soybeans



The protein is taken from the soybeans and mixed with alkaline chemicals to make a thick, gummy solution. This is placed in a tank at one end of a machine and a pump forces it up through tiny holes. Sixty filaments emerge from the holes and these are bonded together into a single strand as they pass through an acid bath and are wound on a reel. After treating with formaldehyde, the "wool" is ready to be spun into yearn.

It is estimated that two acres planted with soybeans will yield about 400 lbs. of synthetic wool per crop. Therefore, a much smaller acreage can be used to produce wool than would be required to raise enough sheep to shear a similar quantity.

Laminated trunk compartment doors for automobiles

The opinion has been expressed frequently that resin impregnated board could not be successfully molded or laminated in the third dimension. Laminating, of

course, has long been done with a right angle, or near-right angle running in one direction only but there have been few examples of molding in which impregnated fiber has taken a definite three-dimensional shape.

A most interesting example of this type of molding is being done experimentally by the Ford Motor Co. on a 1200-ton press. The part is the rear baggage compartment cover, designed for the Mercury car, with an over-all dimension of nearly three by four feet. Almost the entire surface of the piece is curved in contour and its strength and resilience are much greater than contemporary parts formed by metal. Four men have stood on the molded cover at one time without its being damaged.

One cover will weigh between 10 and 12 lbs. as compared with 26 lbs. in metal. There is a low resin content in the center and a high resin content on the surface. Covers have withstood severe tests including subjection to cold until it had accumulated nearly two inches of ice, then placing immediately in a heated room where the temperature was 120 deg. Not one warped.

The mold is a three-ton casting which can be heated in two minutes and cooled in two minutes, molding the completed cover in seven to ten minutes. A metal cover requires several different presses to shape and complete it but the plastic cover can be turned out in one press. The plastic cover is not cheaper to produce but the difference in weight and economy of manufacture will compare favorably in cost when production gets under way. It is less fragile in use and cannot be dented in collision as easily as metal. It is painted and finished just like the rest of the car. (Pictured on page 31.)

These and many other things I saw on this trip clearly illustrate the romance of American industry. They indicate the progress, especially in plastics and their technique of manufacture, that may be expected within the next decade. Truly an exciting period in which plastics probably will appear in perfectly practical applications of unprecedented size and in places where their use in the past has never been even vaguely anticipated.

CLASSIFICATION AND CHEMICAL GENETICS OF ORGANIC PLASTICS

(*Continued from page 52*) prene, in which the substitution of the halogen atom in the molecule has imparted greater resistance to oils and oxidation than that characterizing the straight hydrocarbon polymers. The basic raw material is acetylene, which in the presence of a saturated solution of ammonium and cuprous chlorides reacts to form vinylacetylene. Vinylacetylene by the addition of hydrogen chloride yields chloroprene (2-chloro-1,3-butadiene):

$$2\,CH\equiv CH \xrightarrow[\text{and } NH_4Cl]{CuCl} CH\equiv C-CH=CH_2 \xrightarrow{+\,HCl} CH_2=CCl-CH=CH_2$$

The chloroprene molecule because of its double unsaturation is capable not only of forming long chains by polymerization but also of uniting such chains by cross linkages. This latter reaction is accelerated by heat during the curing operation, when the polymer loses for the most part its initial thermoplasticity.

The resistance of polymerized chloroprene to deterioration by mineral oils and gasoline is responsible for its applications as hose, gaskets, and oil-resisting jackets for insulated cables. The high cost of production eliminates it from competition with rubber for most purposes, but the plentiful supply of raw materials essential to its production makes it of considerable importance from the standpoint of national defense as a substitute for imported natural rubber.

2. *Organic Polysulfide Lastics.* Another synthetic lastic, radically different in composition from the products described above, results from the reaction of various dihalogenated organic compounds with alkaline polysulfides. Thus ethylene chloride and sodium polysulfide yield a polysulfide derivative of ethane which, by curing at an elevated temperature in a manner similar to rubber vulcanization, forms a rubber-like material. The flexibility of the finished product depends upon the sulfur content; a polysulfide low in sulfur, such as the disulfide, yields a fairly stiff material, whereas the tetra- and pentasulfides give products which are very flexible and elastic. Other chlorinated paraffins can be used and the sodium polysulfide can be replaced by any alkaline or alkaline earth polysulfide. Further modification of the process by the use of ethers and aryl halides has been made in actual manufacture and both the aliphatic and aromatic types are available on the market.

The experimental evidence indicates that the probable course of the reaction of ethylene chloride and sodium tetrasulfide may be represented as follows:

$$x\,C_2H_4Cl_2 + x\,Na_2S_4 \xrightarrow{-2x\,NaCl}$$

$$-C_2H_4-\overset{\overset{S}{\|}}{S}-\overset{\overset{S}{\|}}{S}-\left(C_2H_4-\overset{\overset{S}{\|}}{S}-\overset{\overset{S}{\|}}{S}\right)_{x-2}-C_2H_4-\overset{\overset{S}{\|}}{S}-\overset{\overset{S}{\|}}{S}-$$

The reactive polysulfide bonds provide the means for cross linking between the long chains. This synthetic lastic has many applications where a flexible material resistant to gasoline, oil, organic solvents, and ozone is required. Among these may be mentioned gasoline-hose lining, flexible covering for oil reservoirs, and protective sheathing for electric cables.

3. *Miscellaneous Lastics.* Various unsaturated olefins obtainable from petroleum produce by suitable chemical treatment materials properly classifiable as lastics. Thus, the polymerization of isobutylene yields a product described as being extremely tough, white, somewhat elastic, and having a texture resembling that of crepe rubber. Other rubber-like materials have been produced by the reaction of sulfur dioxide with isobutylene and other olefins.

There are also a number of chemical reactions which ordinarily yield hard resinous polymers of negligible

extensibility, but which may also be controlled in such a manner that rubber-like substances are produced. The polymerization of styrene is an example of a reaction of this type. The variation in the products of the condensation reaction of ethylene chloride with the sodium polysulfides, ranging from hard brittle substances to soft elastic masses depending on the amount of sulfur added, has already been mentioned. Reactions of this type bring out very clearly the arbitrary nature of the division of these macromolecular materials into resins and lastics.

Other rubber-like plastics can be prepared by suitably plasticizing various resins. Thus, a solution of vinyl chloride resin and tricresyl phosphate prepared at an elevated temperature yields a product which is solid at ordinary temperatures, is thermoplastic and elastic, and can be worked with the usual rubber machinery. The vinyl acetal resin used in the preparation of laminated glass is another example of a resin which when plasticized is characterized by extensibility and retractivity.

PRACTICAL MOLDED DISPLAY

(*Continued from page 36*) and that bright light be achieved both attractively and economically.

It was decided that a common household type bulb would keep the cost down. Yet all displays in the past that had any pretense to slimness and pleasing form used tubular lamps to make the display slender when viewed from the sides. The location of this sign was to be at the back of a bar or fountain. Therefore, the usual angles of viewing were plotted and a light housing developed that permitted the molded plastic case to be gracefully slender, while the light itself was completely outside the housing in the back. This solution was important since it kept the heat of the lamp from affecting the light-colored plastic.

To lower die cost, the assembly was carefully studied for possible economies. Molding the entire frame in one unit, would eliminate the horizontal joint that connects the vertical sides with the top of the plastic housing. The effect of the shadow that would be cast by this joint was difficult to visualize. Also the design of the decorative detail on a *translucent* plastic which is viewed by direct light was found to be quite different from that which could be planned for a plastic housing viewed by reflected light. However, low production volume was the control and the simplest die possible was the aim. This meant vertical sides, horizontal top, a semicircular in section. Tooling was cut *in* on the model for economy in hobbing the vertical sides. A wood base was used—again a factor determined by cost. The assembly was achieved by screwing the two side units of the plastic frame to the wood base with wood screws. The top snaps in and the steel light housing slides down in place guided by channels in the molded plastic. Thus the assembly is held together by two wood screws.

For the joint between the vertical sides and the top of the plastic frame, a positive lock was desired which would permit the unit to be picked up by the top, but screws or pins were to be eliminated. The result was an undercut around the end of the skirt on the top unit, and a mating projecting ridge on the inside of the lap of the vertical members. The concept was not as difficult as the solution, but the use of the molded plastic insured a successful undercut.

In the final analysis, the cost of this display was found to be very favorable, the unit cost of dies representing a real achievement. The fact that there was a translucent material, readily moldable, in any color of the rainbow, that could take stress and support the whole assembly was a new stimulus in design. In addition to the lovely color effects the urea resins attained, there were no finishing costs and amazingly little breakage in assembly. Moreover, the light weight of the plastic reduced handling and shipping costs and its durability and strength cut damage and replacement charges. The display has been on the market now for several months and the consumer reaction is enthusiastic.

Here is evidence of a new growth in the industry, because even though the designing and tooling costs were well paid, the resulting job was highly acceptable in a competitive market. Realize that a plastic is the only translucent material that can be molded to accurate tolerances and that can take supporting stress in assembly—and this plus safety from breakage and stunning color appeal. Indeed, when manufacturers are willing to really study their point-of-sales advertising with high production in mind, this new material will produce the most striking displays of tomorrow.

ACRYLIC RESINS EASILY WORKED

(*Continued from page 33*) degree by polishing the surface with a good automobile wax (you know the one we mean) before any of the handling operations are undertaken. To protect its luster, this waxing should be repeated after the object is finished. This will protect the surface from finger prints and make dusting or cleaning an easy matter.

When drilling or sawing operations are completed, on the edges where cutting or drilling has been done, the surface may be dulled but the original luster can be restored by polishing or buffing but care must be taken not to over-heat the material through this operation or surface-drag may result.

It would be quite impossible in this brief space to set down all the rules governing successful fabrication of acrylic materials but if the simple rules outlined are followed in the beginning, experience will quickly reveal the proper technique to follow in each operation undertaken. Since each application will present its own problems, it is suggested that beginners experiment with miniatures before attempting full scale creations. Decorators and architects, of course, will find well equipped shops manned by experienced craftsmen to turn out the designs they create.

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SIDELIGHTS ON PLASTICS IN EUROPE

(*Continued from page 37*) more and more plastic conscious, as evidenced by new maufacturing plants which are being built. Casein plastics still form a large percentage of Italy's trade. Injection molding is gaining constantly and affects the sale of Corozo nuts used in the manufacture of buttons and novelties.

It is noticeable that molded products for decorative or household applications in Europe show a better finish than equivalent American articles. They are more often buffed and polished thus bringing out better color values. Urea moldings in France and Germany show very beautiful color ranges; the colors are clearer, deeper, and more expressive. One company in Germany, specializing in tableware and the like, features a combination of plastics and glass. The ensemble is designed as a unit and some very attractive effects are obtained. The unique handling of these two materials places these products in a class by themselves and makes the prices less competitive. A similar movement is on foot in England and, I understand, also in the United States.

While Europe is quite productive in the development of new materials and processes, the United States adopts these new ideas and converts them into finished products on a mass production scale, and what is equally important, it sells these products at a price suitable to the purse of that part of the population which forms the largest buying power. One needs only to compare chain store displays in America and abroad, to have that point brought home. Not only is the variety much larger, but many designs of any one article are offered and the price is usually lower. When discussing that subject I was frequently told: "But look at your population, your very much larger market." Of course that is true, but only partially. The real reason is, that due to the ingenuity in exploiting style and design, the per capita consumption of plastic goods in the United States is higher. The potential British market, considering the export possibilities in the United Kingdom, is almost as large if not equal to that of the United States.

Prior to 1936 Germany was the largest producer of injection moldings, and the best machines for that purpose were built there. America while slow in accepting that form of molding is now the largest producer. In 1936 there were approximately 25 machines in operation. To-day America has about nearly 800 machines operating. The largest and most productive machines are now made here and in many instances are used by Europe's foremost molders.

The rapid development of injection molding did not seriously affect compression molding, in fact it was a stimulant. It did, however, have a detrimental effect on cast phenolics, particularly in Germany and to a somewhat more limited extent in other countries. During the last few years German cast phenolic production dropped more than fifty percent.

It is interesting to note the difference in the development of cast resins in the United States and Europe. Although these resins, either the phenol or the urea type, were the first solid resins to be used commercially, they were never fully exploited until new methods of production were created and developed whereby phenolic resins could be turned out on a large scale at a low price. Outside of lead molding, recent developments in that field are the use of rubber molds, split molds, molds with inserts, and the production of molds by die casting. European manufacturers never have taken to that type of resin seriously, while in the United States, refinements in manufacture, and production, are responsible for the renewed interest in this beautiful material. In many cases cast resins form the stepping stone for the novice in the world of solid plastics, inasmuch as they can be used without special equipment of any kind. The average European equipment for the production of cast resins is inadequate and no effort is made to develop special fabricating machinery necessary to reduce costs. England now has in operation a very modern cast resin plant. However, the prevailing political unrest has a severe effect on all business except the production of armaments, which makes it difficult for this or any new industry to expand. Under normal circumstances, Great Britain, with her large markets should prove a good field for that type of plastic.

A great deal of interest is being shown abroad in resinous adhesives suitable for the production of plywood for aircraft, also in resins for the lamination or coating of paper applicable to the same purpose. The greatest progress along these lines has been made by Germany where once again necessity has proved to be the mother of invention. The new German Volkswagen (peoples' car) makes extensive use of plastics. A large part of the body consists of laminated paper which is also termed "hard" paper. Comparative tests show that hard paper motor car bodies or structural aircraft parts compare more than favorably with those of wood and metal composition or those of the all metal type. Laminated paper of that type is now made with a tensile strength of 35,000 lbs. per square inch and continuous improvements are being made in that direction. It is impressive to see how this laminated paper flows into the various shapes although the finished unit consists of many different sections of varied character such as window sills which flow into the very thin section of a door These motor car and aircraft parts are molded to a high degree of accuracy and detail which is surprising when one considers how large some of these parts have to be. In aircraft design the joint or bond between the different abutting pieces forms the key to the adaption of plastics for structural parts, especially for wing sections. Very ingenious joints have been developed and are giving increasing good results. Hard paper is also made in solid blocks to replace stone, iron, and bronze. This type of paper resists acids, heat, and extreme climatic conditions. It can be worked with a hammer and chisel just like marble, and is suitable for monumental art among other things.

The application of plywood or improved wood to aircraft design finds its best exponent in America. British aircraft designers as well as the air ministry are in a dilemma as to whether to follow the lead of America

by using plywoods, or to utilize the German methods, namely: laminated paper or hard paper. France is experimenting with both types.

One of the difficulties in laminating heavy sections of wood with liquid resins or resinous films lies in the fact that wood having a low heat conductivity resists the penetration of heat, particularly in heavy sections, so that rather thin layers of wood have to be used for that purpose. Special bent shapes can only be produced after the lamination. A new resinous film is now in use in Germany in which there is imbedded wire mesh with suitable taps on the outside whereby the glue joint is electrically heated and a perfect bond is obtained with or without pressure. This process makes it possible to join or bond several sections of either laminated or plain wood of any shape without special equipment. In fact, the sections can be laminated wherever they have to be used as long as there is low voltage electricity available. Even this wire mesh process is being improved upon by the substitution of suitable electrical conductors other than wire mesh. In some cases wire mesh presents difficulties which the new method eliminates.

Tubular transparent containers made by a dipping or extrusion process are produced by two factories in Europe which specialize in that type of product. Two very similar processes are employed. The difference is that one method provides for the removal of the container from the mold by stripping it off, that is by turning it inside out, while the other method uses a lubricated arbor or mold and the container is removed by air pressure. Some types of these tubes are made by a centrifugal process. The material used for this purpose is usually a cellulose acetate. However, one prominent German company shortly will produce these transparent bottles and containers in polyvinyl resins by new improved methods. Special equipment has been developed for the production of necked bottles and the application of molded bottle tops. English as well as American interests have adopted one or both of these processes and production will shortly begin in both countries. Polyvinyl resins offer many advantages and the resulting products are not only more suitable for many of the present applications but they also open up additional markets for the use of plastics.

The lowly potato is receiving increased attention on both continents. A new transparent thermoplastic material utilizing potato starch has recently been developed in Holland and is now manufactured in transparent as well as opaque form. The transparent material has very desirable optical properties especially in connection with ultraviolet light. It can be drilled, sawn, shaped, or cut, and is furnished in a wide variety of colors. It is, however, somewhat hygroscopic, but can be used for diverse applications where a certain absorption of moisture is not detrimental.

Plastics are stepping ahead in giant strides; they form an important part of our age and exert their beneficial influence on all mankind. Neither boundaries nor national faith can stop their never ending progress.

A.S.T.M. METHOD FOR TESTING THE RESISTANCE OF PLASTICS TO CHEMICALS

(*Continued from page 49*)

Test Specimens:

5. (*a*) The test specimen for molded materials shall be in the form of a disk 2 in. in diameter and 1/8 in. in thickness when comparison with values for other plastics is desired. The surface area of this standard disk is 7.068 sq. in.

(*b*) The test specimen for laminated and sheet materials shall be in the form of a bar 3 by 1 in. by the thickness of the material which shall preferably be 1/8 in. when comparison with values for other plastics is desired. The surface area of the standard bar is 7 sq. in. The permissible variation in thickness of the standard 1/8 in. thick specimen used in this test shall be plus or minus 0.008 in., and the permissible variation in total surface area exposed shall be plus or minus 5 per cent.

Procedure:

6. (*a*) The plastic shall be tested in all of the standard reagents and any specified supplementary reagents. Three specimens shall be tested in each reagent. Each specimen shall be weighed separately in the as-received condition. The diameter or length and the thickness at the center shall be measured to the nearest 0.001 inch.

(*b*) The specimens shall be totally immersed for 7 days at a temperature between 25 and 30 C. The specimens shall not be conditioned, but shall be tested in the as-received condition. They shall be totally immersed by placing them on edge in a container and supported on an angle by the bottom and side wall of the container. At least 50 ml. of reagent shall be employed for immersing each specimen.

(*c*) The specimens removed from acid, alkali, and miscellaneous solutions shall be washed with running water, wiped with a dry cloth, and weighed without delay. The diameter or length and the thickness shall be measured immediately after weighing.

(*d*) The specimens removed from solvents shall be wiped dry with a cloth. Some specimens may remain tacky due to dissolved material on the surface or solvent absorbed throughout the specimen. This condition cannot be avoided. The specimens shall be weighed and measured immediately after wiping.

Report:

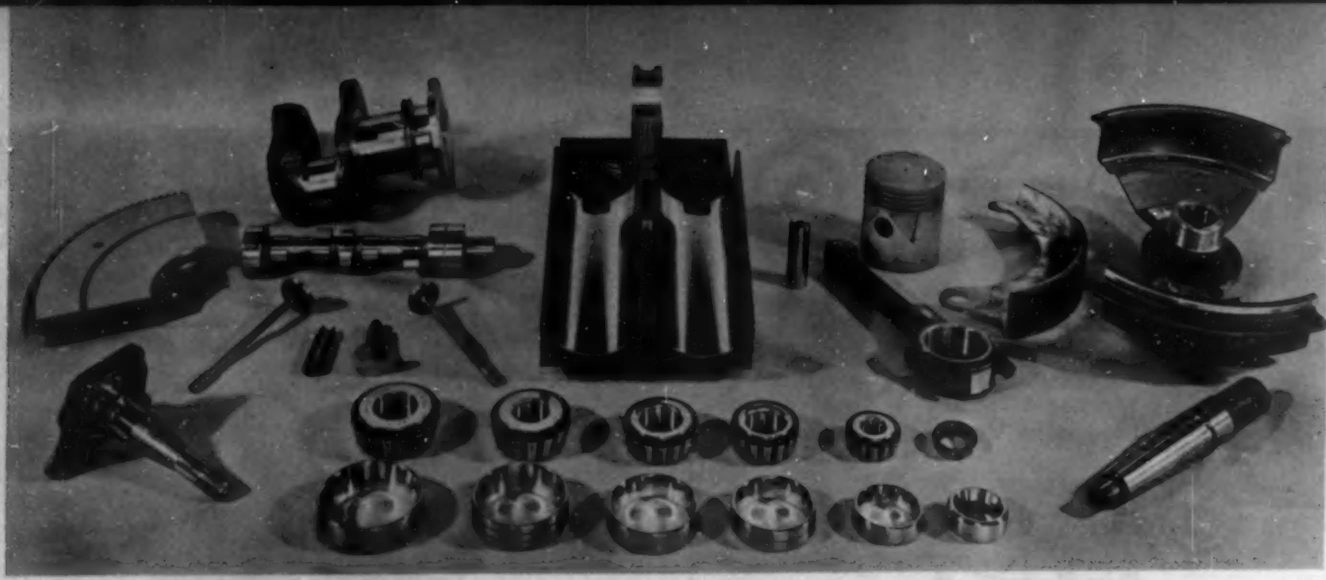
7. The report shall include the following information for each specimen tested in all the standard reagents and any specified supplementary reagents:

(*a*) The initial thickness in inches measured at the center to the nearest 0.001 inch.

(*b*) The percentage loss or gain in weight during immersion for 7 days, calculated to the nearest 0.01 per cent, taking the as-received weight as 100 per cent.

(*c*) The percentage increase or decrease in the diameter or length and the thickness, taking the as-received dimensions as 100 per cent.

(*d*) General character of specimen after immersion.



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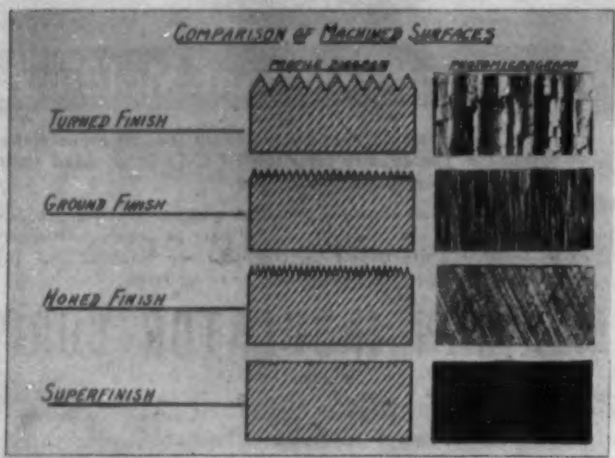

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Fig. 10. Chrysler uses superfinish in full production on crank-shafts, crank-shaft main bearings, crank-shaft pin bearings, cam contours, bearing journals, cylinder bores, pistons, piston pins, valve tappet heads, valve stems, fly-wheel clutch faces, clutch throw-out plates, cylinder block line bearings, brake drums, and molded brake shoe linings. (Pictured above)

Fig. 11 compares conventional surface finishes with super-finish on the same part. Any defects remaining in the superfinished surface are below the base line. Both are shown in magnified profile and photomicrographs

SUPERFINISH FOR MOLDS?

(***Continued from page 27***) the stones could scrub away all day without any appreciable change in the character of the surface. This point is reached when crystalline structure is exposed, and the piece is then superfinished. The viscosity of the oil thus has an important bearing on when the cutting (scrubbing) action stops, and the surface has been properly finished.

In this connection, it is pertinent to point out that the process is not intended to correct dimensional errors or to form or shape the part. The stones are usually mounted free floating and will follow the contour of surface and remove the high points. Under certain conditions the process may be used as a sizing operation.

In preparing a part it is not necessary to go through all the stages of turning, rough grind, finish grind, etc., before superfinishing. In many cases it can be done directly on a turned surface, and at best a medium rough grind is preferred as a starting surface. It has been found that previous operations often can be eliminated, or at least reduced in time. The stress on previous operations is put on dimensional accuracy rather than on surface finish of the part.

From the pioneer efforts in removal of "fuzz" or smear metal from bearing races, this process has progressed until today it is used in full production on crank-shafts, crank-shaft main bearings, crank-shaft pin bearings, cam-shaft bearings, bearing journals, cylinder bores, pistons, piston pins, valve tappet heads, valve stems, fly-wheel clutch faces, clutch throw-out plates, cylinder block line bearings, brake drums, and the molded brake shoe lining. A group of these parts is shown in Fig. 10.

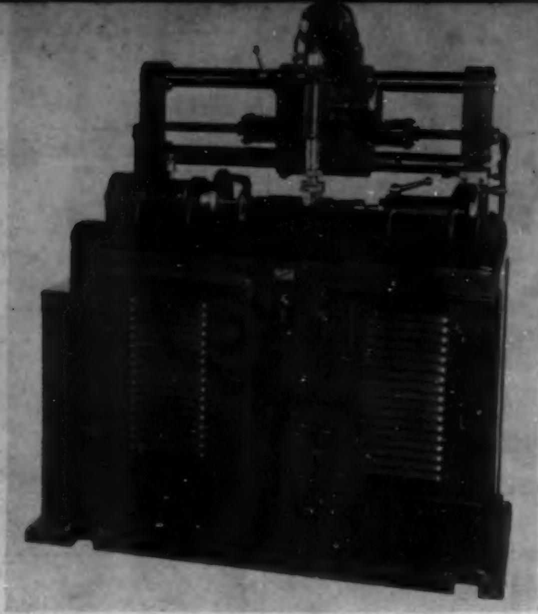
Up to the present, Chrysler Corp. engineers have been concerned mainly with production parts in automobiles, but at the same time along with other companies licensed to make superfinish machinery they have expanded the field and shown its unlimited possibilities.

Today this finish is used, or machines are being designed, for a great variety of applications such as: watch parts, steel rolls for rolling mills, mold boards for plows, tire molds, paper rolls, valves, airplane parts, injectors for Diesel engines and many more.

It is not the intent of this paper to give the impression that any or all plastic molds can be superfinished entirely. In fact with present design of molds some could only be so treated on face or parting line of mold. Machines are developed, however, which will provide a means to reach the important parts of molds. In fact there is on the market now, attachments (Fig. 12) that can be put on lathes, shapers, etc., for processing surfaces.

There is also available a 4 in. by 18 in. Tool Room Finisher for cylindrical and flat work (Fig. 13), and a Flat Finisher (Fig. 14). (*Please turn to next page*)

12



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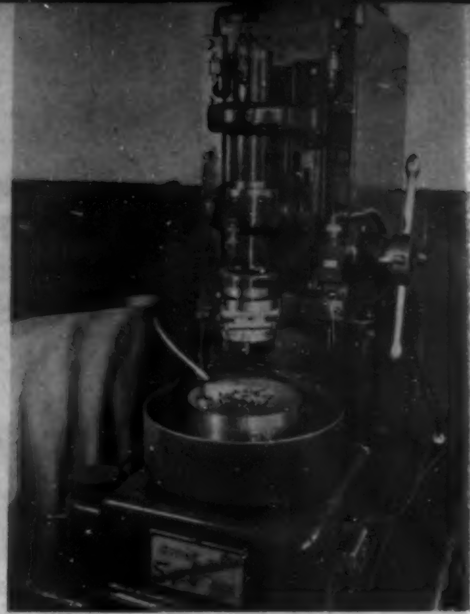
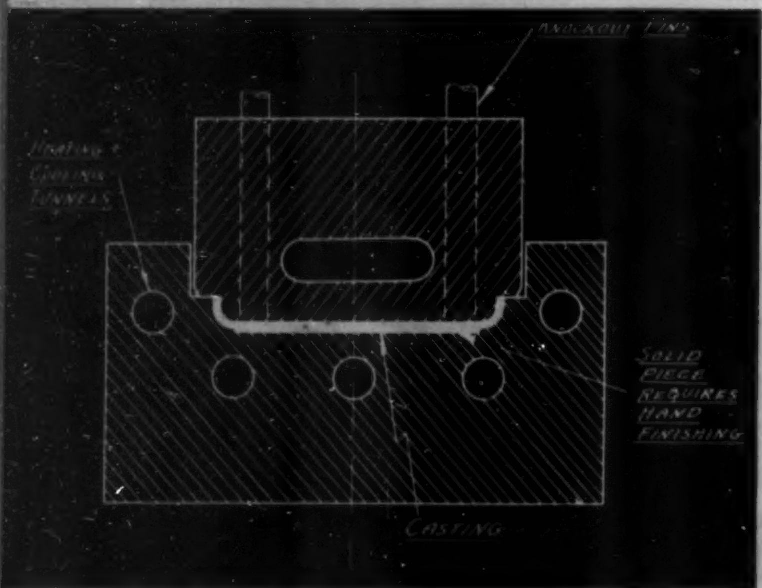


14

A lathe attachment (Fig. 12) makes it possible to superfinish cylindrical parts that can be held in an ordinary engine lathe. Fig. 13 shows a 4 in. by 18 in. Tool Room Finisher for cylindrical and flat work. The cylindrical attachment is pictured. A Flat Finisher (Fig. 14) has a capacity of 16 in. in diameter. Fig. 15–16 illustrate a conventional and suggested design for a die to mold plastic box tops. It is believed that superfinishing could be applied to dies built up in the manner suggested



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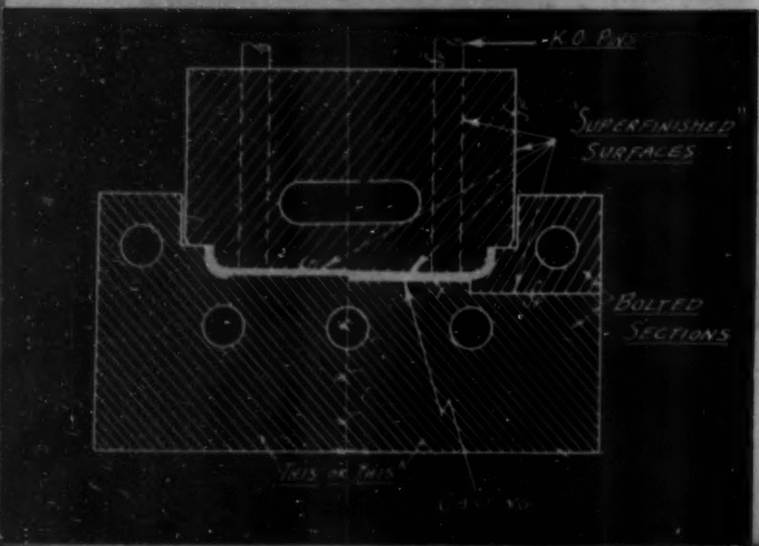

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Injection machine owners are aware of the importance of smooth surface in heating tunnels, and nozzle construction to prevent burned material, and to facilitate cleaning of machine when changing color or material.

It is very likely that design of part, design of molds and development of these special machines must go hand in hand to provide the maximum use of the finish in mold making. The advantages to be obtained on molds are:

(1) Speed of the special process will reduce mold finishing cost.
(2) Mold parting lines can be made as smooth as mold cavity with no extra cost.
(3) Surfaces will be truly smooth and without surface defects (not merely a reflecting surface).
(4) Ease with which large mold surface may be refinished providing mold design is suitable.
(5) Surfaces will be easier to keep clean.
(6) The resulting surfaces will offer less resistance to flow of material for injection molding, with the consequent elimination of many flow lines, and surface defects.

The first step in the use of superfinish in mold making will undoubtedly make use of present flat, cylindrical (internal and external) machines. These may be applied by developing a new technique in building up molds. Figs. 15 and 16 illustrate the conventional and suggested mold design for a box top of this character. In general, the principle will be to finish the face or larger surfaces on a flat block, with details built into mold by adding sections. Some experimental and production molds will be built in this manner during this year.

As the demand by mold makers becomes evident for a fast and economical method of producing the ultimate in surface finish on molds, means will be developed and machines built. Experimental research along this line has already proven the possible use of this superior finish to any kind and every conceivable surface.

The second step, as indicated before, will be the development of special machines for mold makers, which will certainly be a means of reducing mold costs.